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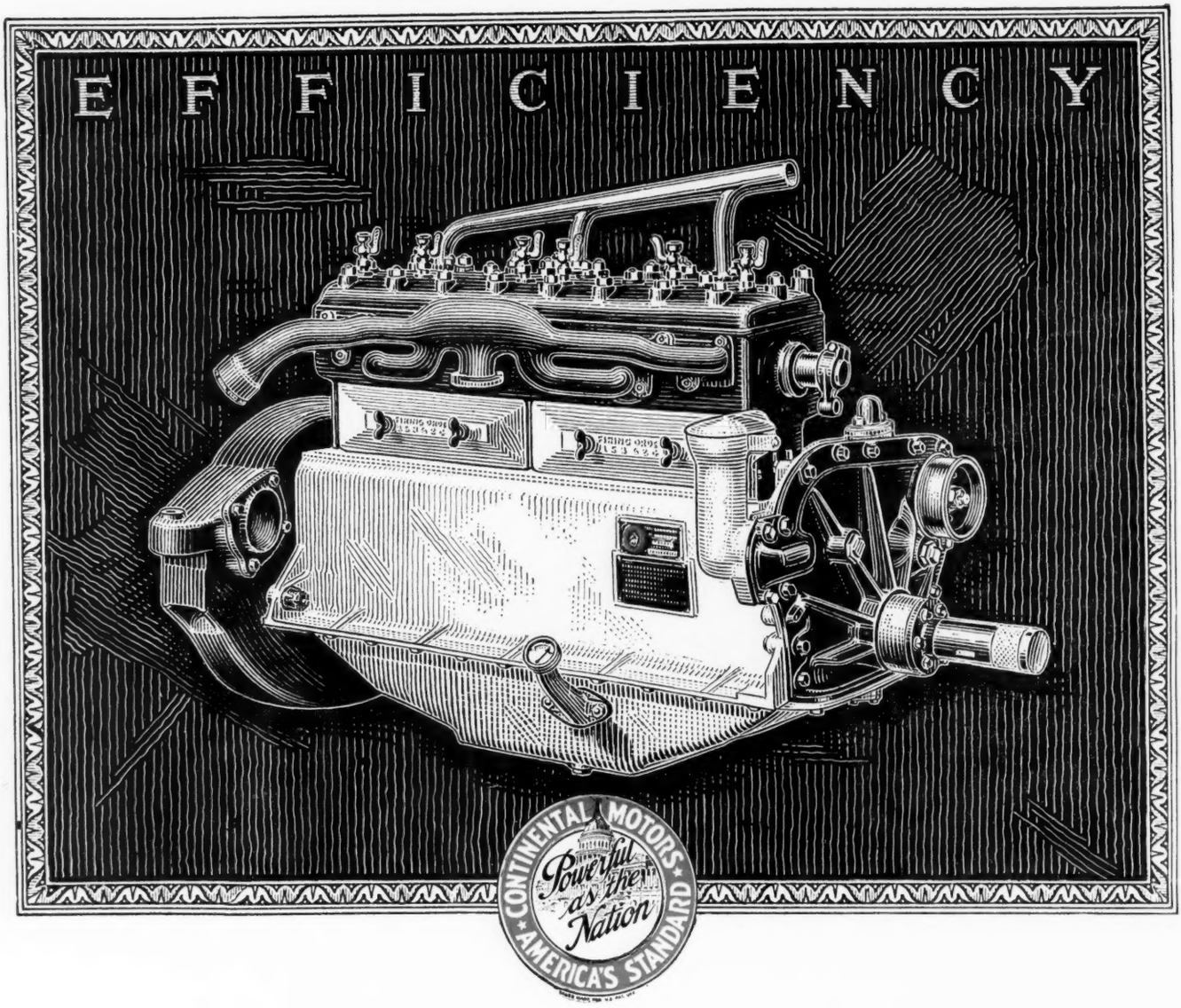

In the great Continental plants, EFFICIENCY greets the observer on every hand. It is seen in mechanical operations where simplicity has supplanted duplication and it is revealed in the clock-work routing and progress of motors under construction. ¶ These examples, however, are but manifestations of the wonderful co-ordination of effort that the industry calls Continental EFFICIENCY—co-ordination of effort internally in every phase of motor building and co-ordination externally in hand and glove co-operation with the entire transportation world. ¶ It is only natural, therefore, that the product of this great organization, in its smooth-running precision of operation, should possess that rare degree of motor EFFICIENCY that always has been associated with—the Continental Red Seal.

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AUTOMOTIVE INDUSTRIES
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VOL. XLV. NEW YORK—THURSDAY, SEPTEMBER 15, 1921 No. 11

Stability as Related to Present Price Trends

Price cuts have a psychological effect upon the mind of the buying public. Stability, viewed as a moving state of balance, can be achieved on a sound economic basis. A discussion of fundamentals.

By Norman G. Shidle

SIMILAR effects do not always grow out of similar causes. This is especially true of the recent price flurries in the automobile industry. The general reduction in prices which followed Ford's initial cut some months ago was a logical fall from wartime values. It was a logical step in the general deflation—a step taken on a sound basis of practical economics. The causes for a general reduction of prices at that time were clear and the same causes affected the entire industry in common.

The present situation is more complex. There is no common cause for price reductions. Despite the fact that reductions have been widespread during the last two weeks, an analysis of the situation indicates a great variety of reasons for the cuts. In almost every case where a reduction has been made, the reason appears to lie in certain individual factors affecting the company concerned. That no common basis is to be found in the present situation is indicated by the fact that cuts have been made both by companies whose sales have been exceptionally good during recent months and also by companies whose sales have not reached satisfactory levels during the same period.

An attempt to analyze and discuss the different reasons for present reductions would be as difficult as it would be useless. The immediate problems which confront the manufacturers are individual and will be solved on the basis of the peculiar factors involved in each particular case.

There is a definite value, however, in discussing at this time certain fundamentals, the operation of which will determine the progress of the industry in the long run. While forces bearing upon an individual concern at present may necessitate certain temporary measures, an attempt to keep these temporary measures as closely as possible in line with the fundamentals will hasten the return to stability.

Stability in the automobile business during the next few years must be conceived, not as a stationary state, but as a state of constantly changing fixed ratios. The industry must be kept in balance, but not necessarily at a constant level. Stability of prices is essential if sound and permanent buying is to be stimulated, but the term need not be conceived to mean that prices will never change. They must be fixed for a period long enough, however, to restore public confidence in the relative value of the product which it buys.

A price war at this time would be ruinous to the industry. This fact is so obvious that it is hardly necessary to state it, yet its importance is so great that it can well be emphasized. An indiscriminate cutting of prices, based only on

guesswork and the price of competing makes, a level of prices changing every two or three months, would simply throw the buying market into confusion, cause untold financial stress among manufacturers, add heavy burdens in the way of unemployment and reduced wages to thousands of workers, and benefit very few, if any, of those involved.

Stability of prices need have no relation to agreements among manufacturers. It should have none. Price agreements do not have a sound economic basis and cannot therefore form the basis of permanent progress. An agreement as to the basis of prices, however, is a different matter.

It is sound economics to manufacture a product as efficiently as possible, to maintain a certain predetermined quality, to merchandise it as economically as possible, and to sell it at a price which gives a fair profit to the manufacturer and the dealer and a fair value to the buying public. This is easier to say than to do. But since it constitutes the only permanently sound and economic basis for selling prices, an attempt to establish such a basis and operate upon it eventually will be found essential.

Prices of materials vary, of course, and affect costs materially. Wage rates vary, production methods vary, merchandising costs vary and hundreds of other minor variables operate to make difficult an accurate determination of costs at any given time. Especially is this true when there is a falling market. Under any conditions, however, sound cost data are essential as a basis of any business or manufacturing operations. Such data are compiled, more or less accurately, in every manufacturing establishment. Incidentally, there is still progress to be made in cost methods.

PRICES must reflect economic value, and adjustments be made on that basis. Stability may be conceived during the next few years as a state in which balance is preserved, although levels may be changed at periods sufficiently far apart to allow fluctuations to depend upon economic trends and production costs.

In any case, the selling price should bear some definite relation to the production and material cost, taking into consideration, of course, market trends and other variable factors. On such a basis, selling prices should be stabilized for a period of a selling season. The period must be long enough to convince the public that prices have been established upon some sound basis. This cannot be done, however, until prices actually are so adjusted.

Price reductions are a part, of course, of merchandising plans, and like other merchandising plans cannot be permanently successful if guesswork is used in determining them. Prices are in a sense the foundation of the merchandising scheme. It should be recognized that stability is likely to be a far more essential factor than is generally recognized. With a sound basis for prices, as indicated previously, fluctuations would take place only when essentially changed conditions indicated the necessity for change and the fluctuation would be such as to preserve the fixed relation between the various factors in the market.

Last week Harry Tipper wrote, "There is no likelihood of a return to the days of easy selling, but there is every prospect of good business for the man who goes after it, who sees that his product is suitable to the market and that it is valued in accordance with its service." The present price flurry adds to the difficulties of the manufacturer in selling, because he must convince the public of the value of his product. He can hope to do this only when he has actually priced that product on a sound economic basis.

Some of the price cuts already made have obviously been made on that basis. The reason for others is not so clear. Certainly the general situation indicates that there is an opportunity for a stabilization in the near future, however, as price curves in many raw materials give strong indications of straightening out.

Constantly recurring cycles of price reductions are certain to have an unfavorable effect upon the public mind. If automobile prices continue to vary, when the price curve on raw materials shows a strong tendency to straighten out, the public is likely to come to the conclusion that automobile prices have not been on a sound value basis in the past and that perhaps they are not at present. Such an attitude would result in a "let's-wait-a-while" buying policy.

Last June AUTOMOTIVE INDUSTRIES quoted the sentiment of those present at the annual N. A. C. C. meeting as summing up something like this:

"It is up to the industry to settle the price question right now and end the feeling of uncertainty that exists in the public mind. People do not buy on a falling market and we must stabilize values immediately." This sentiment indicated a very clear understanding on the part of manufacturers as to the necessities of the situation. The statement applies equally well at the present time. The buying public is composed of individuals very much like the manufacturer himself. Each of these individuals is likely to reason about automobile prices along the same lines as anyone else.

The necessity for stability and the establishment of mutual confidence between the industry and the public and between the various parts of the industry is clear. The failure to recognize a moral obligation in regard to contracts and similar relationships within the industry can never lead to permanent advantage. The recognition of such an obligation has no relation to altruism; it has come to be simply a principle of good business. Mutual confidence can be established only through an attempt at utter fairness all along the line.

One executive within the industry analyzed the situation about like this a few days ago: "Much of the difficulty," he said, "lies in the lack of mutual confidence within the industry. Many purchasing agents are buying for very limited periods ahead because they are uncertain about the price of parts and raw materials. On the other hand, the parts people are afraid to take big contracts and really get into production on them because they are afraid of cancellations. This lack of mutual confidence is costing the industry many dollars every month at the present time."

This has a definite relation to the price question and must be considered as an important factor. Modern industry is composed of a multitude of closely interdependent units and can permanently progress only through a recognition of a moral obligation. The extent to which this is understood and practised will have a large part in determining the facility with which the general readjustments can be made.

In any case, the price future most advantageous to the industry lies in a stabilization, subject to periodic readjustments during the next few years, none of which need disturb the fixed relation of the relative values when made on a sound economic basis of production and material costs.

A New Bus Chassis Developed by International Motor Co.

Rubber shock insulating blocks used in place of metal spring shackles, 34 in. wheels, and mounting of body floor directly on frame give much lower center of gravity, while riding qualities with cushion tires are said to equal those with pneumatics and to give lower operating costs.

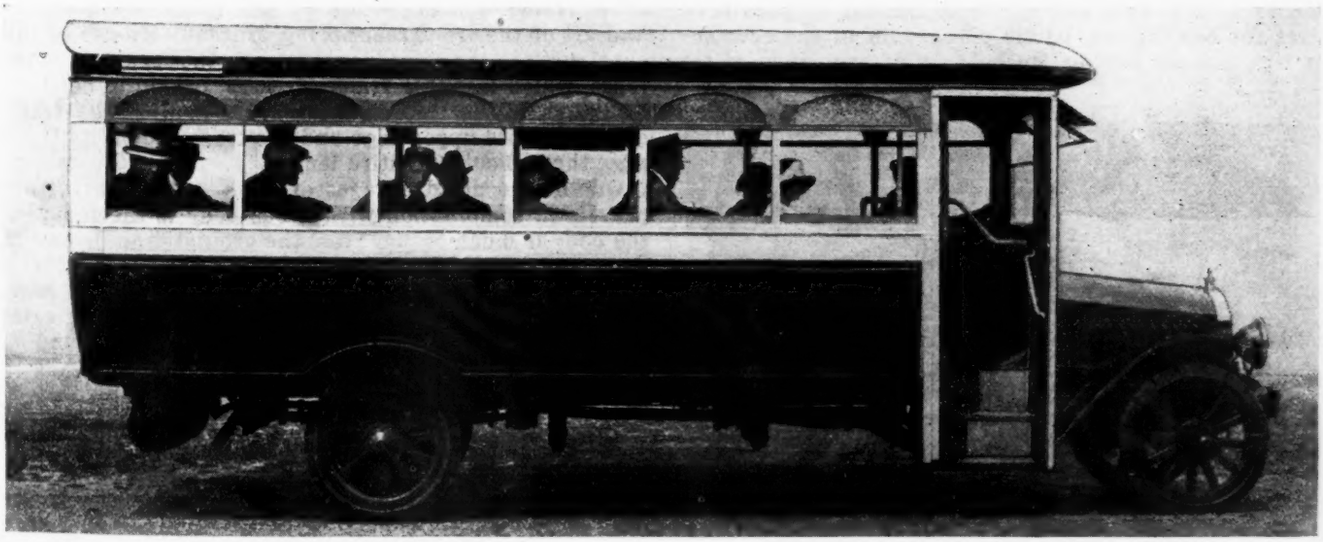
By Herbert Chase

THE International Motor Company, in common with many other truck manufacturers, foresee unusual activity in the bus transportation field, and on this account have undertaken the development of a special bus chassis intended to meet the requirements of this class of work. While the chassis is identical in most respects to the standard 2½-ton Mack AB dual reduction chassis, several new features are incorporated. Of these the newest and most unusual is the use of rubber shock insulating blocks in place of the usual metal spring shackles.

From the accompanying cut it will be seen that blocks of rubber placed under compression in boxes provided for the purpose carry the ends of the springs and thus eliminate metallic contact between the spring and frame members. The rubber blocks are made of especially cured compound similar in some respects to that used in certain grades of solid tires. The boxes used in place of the usual spring brackets are made in two sections. The upper half is riveted to frame in much the same manner as the ordinary spring bracket, while the lower half is bolted to the upper portion. When bolted in place the rubber is placed under a compression about 80 lb. per square inch. The ends of the springs are embedded in the rubber blocks in such a way that the springs can deflect as well as take thrust in the usual manner. In the case of the rear springs the ends of the two upper leaves are carried between two metal liners riveted to the ends of the leaves and in contact on their outer surface with the rubber blocks. The liners increase the area of contact with the rubber, thus decreasing any tendency for wear between the two surfaces. The metal liners are omitted in the case of the front springs, since these have much less motion than the rear springs. Hotchkiss drive is employed in the same manner as when spring shackles are used.

Among the advantages claimed for the use of rubber shock insulators are the following:

1. No lubrication required. 2. Upkeep much less, since no grease cups and no grease or oil is required, and no cleaning is necessary. 3. Ability to insulate the frame from many shocks ordinarily transmitted from the springs, and thus improve riding qualities of the vehicle. 4. No friction between surfaces, consequently no wear, looseness or rattle. 5. The rubber tends to compensate for twisting action between spring and frame. 6. Side and end thrust taken without metal-to-metal contact. 7. Less horizontal motion of axle, because springs elongate from middle toward both ends. This makes for better steering and tends to prevent unnecessary brake action. 8. Tends to reduce so-called "crystallization" of the frame, steering gear parts and other members due to vibration transmitted by shackles of the older type. For same reason the tendency of nuts and rivets to loosen is decreased. 9. Increase in the life of the tires. 10. Does away with shackles, spring eyes,



Side view of the new Mack bus chassis. Note relatively low steps and body floor

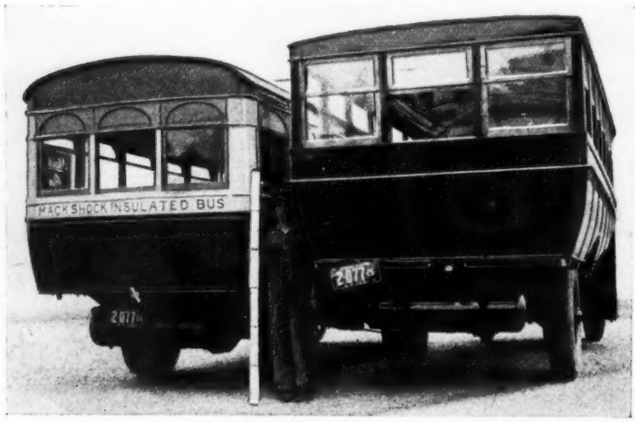
Rear spring suspension used on new Mack bus chassis, showing brackets containing the rubber shock insulators and the rear truss bracket

bushings, hardened and ground steel shackle pins, grease cups, shackle bolts and nuts. 11. Two or more main leaves of the spring can be made to bear in the rubber, thus giving added strength. 12. Spring construction is simplified and cheapened, since no wrapped eye is required. Cost of assembly and replacement is also less than with spring shackles.

The manufacturers state that the temperature of a spring used in combination with the shock insulator was 20 deg. Fahr. lower than in the case of a spring without shock insulator and using the old type shackle under similar conditions, indicating that frictional losses are decreased. A 20,000-mile test run on a chassis using the rubber insulators is said to have indicated that they will stand up for at least 25,000 miles running. The eight insulators used on each truck can, it is said, be renewed by two men in about one hour at a total cost of less than $50, while it is necessary, with the ordinary spring shackle, to renew bushings once in 10,000 miles, this job requiring the labor of two men for about 8 hr.

The rubber shock insulators are supplied only on passenger-carrying vehicles and usually with cushion or high profile tires. The bus chassis is equipped with Kelly-Springfield caterpillar No. 23 compound 34 x 5-in. tires front and rear, the rear tires being dual.

The writer was shown numerous records made on a seismograph to determine the relative ease of riding of the shock insulated bus and a similar bus equipped with pneumatic tires. These appeared to indicate that the insulated bus is quite the equal if not superior in riding qualities to the pneumatic equipped job, and the makers so regard it. The International Motor Co. believes the use of solid tires is preferable to the use of pneumatic tires for bus service, partly on account of the economy of tire expense and partly because of avoidance of the danger which is said to be involved in operating a heavy vehicle at high speed in case a large pneumatic tire blows out. The following figures on the relative cost of operation with solids and pneumatics are given by the International company: "On buses operating 50,000 miles annually five or more sets of pneumatic tires are required per year, costing not less than $3,200. For a bus equipped with rubber shock insulators three sets of solid tires should cover a year's operation at a cost of approximately $970—thus producing a net saving of $2,230 per year, or nearly 4½ cents per mile."



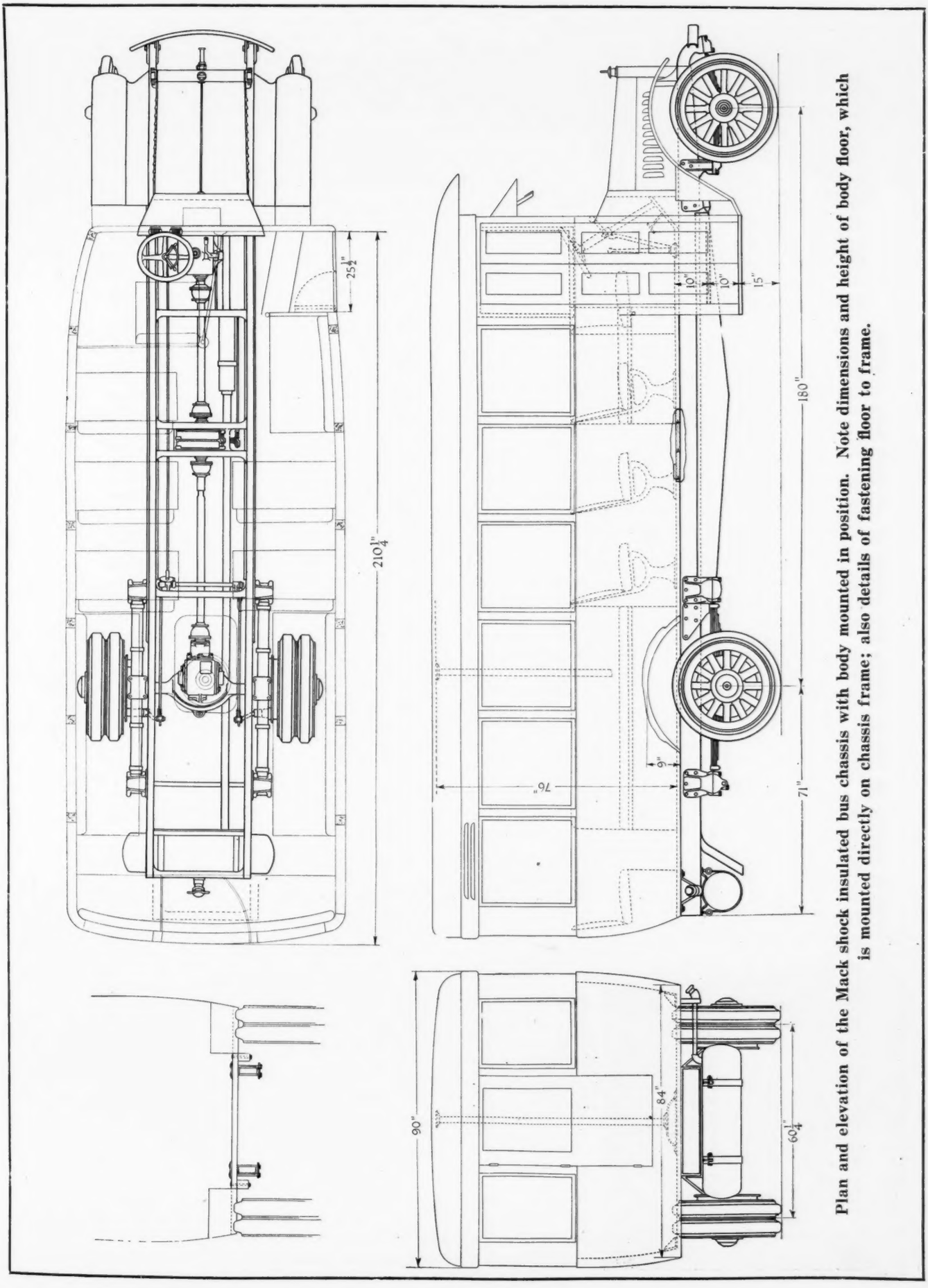
View showing comparative platform height of the Mack shock insulated bus and a bus of the same make but earlier design equipped with pneumatic tires

One other feature which materially affects the riding quality of the Mack bus is the use of unusually long rear springs. These measure 60 in. from center to center of the spring brackets.

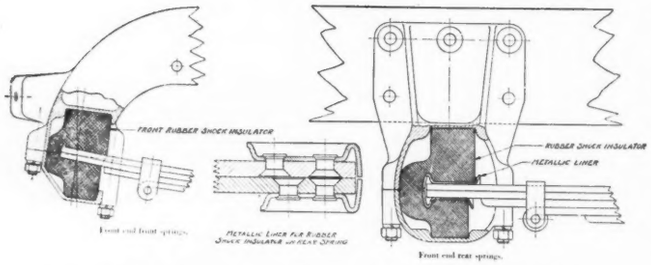
It will be seen from the accompanying drawings of the bus chassis and body that the latter is designed to carry 25 passengers. The cross seat arrangement shown gives a maximum of seating space. In case the bus is used in traffic which requires more standing room, this can be provided by other arrangements of the seats. In order to give the required body space it has been necessary to materially lengthen the frame and wheelbase of the chassis. This, in turn, has made necessary a reinforcement of the frame by means of truss members on each side. A combination wood and metal truss is employed, as shown in the accompanying cut.

The tension member of the truss is a steel rod with a round threaded section at each end, but flattened into oblong section between ends. This flattened section is mortised into the wooden filler member and is tightened by nuts which pass through substantial brackets riveted to the frame at points aft of the rear front-spring bracket and aft of the front rear-spring bracket. By use of this construction the disadvantages of the ordinary open truss, which localizes frame stresses, is said to be eliminated, since the wooden filler bears against the frame channel on its upper edge and the truss rod on its lower edge throughout its entire length.

One of the disadvantages of using an ordinary truck chassis in combination with a bus body is the fact that the body is much higher from the ground than desirable, and is consequently more difficult of entrance and exit than a lower body would be. The higher center of gravity detracts from the riding qualities and causes greater tendency for the bus to sway or tip over when rounding curves. For these reasons an effort has been made to lower the bus body in the design of the Mack bus chassis. This has been accomplished by use of a 34-in. instead of a 36-in. wheel, by elimination of the spring shackles and by mounting the floor of the bus body directly on the chassis frame in the manner indicated in the accompanying transverse sectional view of the body. The photograph of the Mack shock insulated bus beside a bus of older design mounted on a higher chassis frame and



Plan and elevation of the Mack shock insulated bus chassis with body mounted in position. Note dimensions and height of body floor, which is mounted directly on chassis frame; also details of fastening floor to frame.



Sectional views of the front and rear brackets for holding the rubber shock insulators which support the spring ends

equipped with pneumatic tires gives an excellent opportunity to judge of the decrease in height which has been effected. The difference in height to the top of the chassis frame is 7 to 8 in.

Other particulars in which the bus chassis differs from standard Mack AB truck chassis are as follows:

The muffler pipe is extended to the rear of the chassis in order that the exhaust gases may not enter the body in the vicinity of the entrance door. The gasoline tank is located outside of the body in the rear of the chassis, fuel being fed to the carbureter by means of a vacuum system.

The engine is substantially the same as that used in the truck chassis, except for slightly different clearances used on pistons and valves made necessary by the fact that the engine runs at a higher governed speed than in the case of truck applications. The engine is governed to 1425 r.p.m., as against 1275 for the standard truck engine.

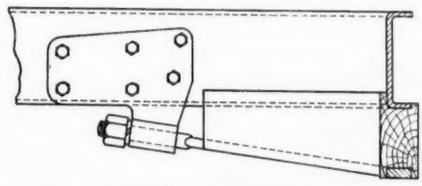
The four-speed gearset, dual-reduction rear axle, the front axle, steering gear and other mechanical units are substantially the same as those used in the truck chassis.

The standard bus body is substantially built. All body frame members are of first-quality, thoroughly cured oak with mortise and tenon joints set in white lead and dowelled with oak pins. The floor of the body is of 1¼-in. tongue and grooved maple, with maple wear strips attached. The seats are carried on light, pressed-steel pedestals. Seat cushions are given a tilt aft, are covered with imitation leather and provided with comfortable springs.

A two-leaf folding door is provided at the front of the right side of the body. It is arranged for operation by the driver from his seat. Three steps, the height of which is shown in the accompanying drawing, are provided at the entrance. An emergency exit, which can be opened from the inside in case the entrance door is blocked by accident or otherwise, is provided. The windows are equipped with anti-rattlers and have movable lower sashes which drop into the casing beside the seats. Eight electric dome lights are distributed over the ceiling, and a step light, located inside the body, is so arranged as to be lighted automatically when the door opens. A heating system, using exhaust from the engine, is provided. This consists of two lines of guarded pipe running the full length of the body on each side near the floor. A valve controlling the by-pass of exhaust through the heating system is located under the floor near the entrance door. Two front and two rear ventilators with shutters are provided. Advertising racks for standard size advertisements extend along the inside of the body on both sides above the windows.

The bus is, of course, arranged for one-man operation. The driver is protected by a rail, and a sliding curtain placed back of the driver's seat prevents reflection of light on the windshield when driving at night. A mirror placed over the operator's seat is arranged to give him a view of the interior of the bus and, through the rear window, of the road behind.

The length of the body inside at the seat line is 18 ft. and the width at the same point 6 ft. 7 in.



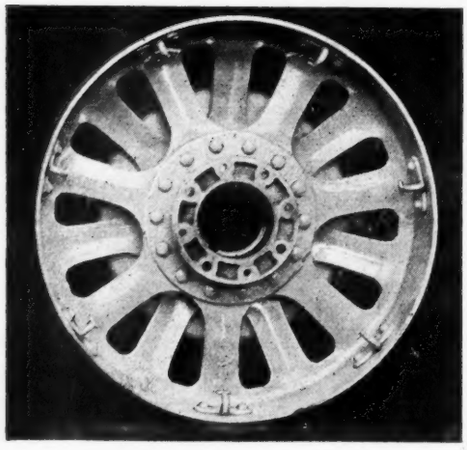
A detail of one truss rod bracket. One end of the truss and a sectional view through truss and frame are also shown

The following additional body equipment is furnished at extra cost. Newbold lighting system, consisting of a special generator with automatic regulator arranged to charge the battery and feed the lighting system at a constant rate irrespective of speed of engine. Electrically lighted roller destination signs. Electric buzzer system with buttons located on window posts. Spring-roller window curtains, spring-edged cushions, ceiling of Agasote or similar material attached to roof bows, and fare register.

The price of the bus chassis with 25-passenger body and standard equipment is $6,730.

A Rolled Steel Truck Wheel

A ROLLED steel truck wheel in which the rim and spokes are formed in one piece is now being produced by one of the large steel manufacturers. The blank from which the wheel is formed is stamped in the first instance from a special rolled I-beam, portions of which form the spaces between spokes being cut away before the forming operation is started. When the wheel has been formed to assume a circular shape, the ends of the flange which then becomes the rim of the wheel are welded together, and the inner spoke ends are bolted to a central hub member, alternate spokes being staggered and bolted to opposite sides of the hub flange. The wheel forms a rigid structure which is said to compare favorably in weight with that of a wood wheel, and to be amply strong to withstand the most severe radial loads and side thrust as well as torsional strains. A rear wheel with brake drum attached is shown in the accompanying cut. Front wheels are identical except for the hub construction and elimination of the brake drum. The chain hooks shown in the cut are cold riveted to the rim of the wheel when desired. The entire wheel is manufactured from the raw stock by the Bethlehem Steel Corporation.



The Bethlehem rolled steel wheel constructed from I-beam by stamping and forming operations.

Producer Gas as a Fuel for Automotive Vehicles

Part II—Descriptions of Existing Systems

British engineers have developed three gas producer systems intended for use on trucks. A description of these systems and their method of operation is given herewith. 300 lb. of coal will, it is claimed, drive a truck 100 miles, or about the same distance as 20 gal. of gasoline.

By P. M. Heldt

At least three different gas producers for use on motor trucks have been developed in Great Britain. These are described here briefly and illustrated to show the methods employed for overcoming various difficulties. Among these difficulties is that due to the volatile constituents and the carbon dust carried along by the gas, which has already been referred to. Another difficulty with producers arises from the formation of clinkers. In the combustion zone the temperature is so high that the ashes fuse into clinkers, which clog the grate and prevent the entrance of sufficient air.

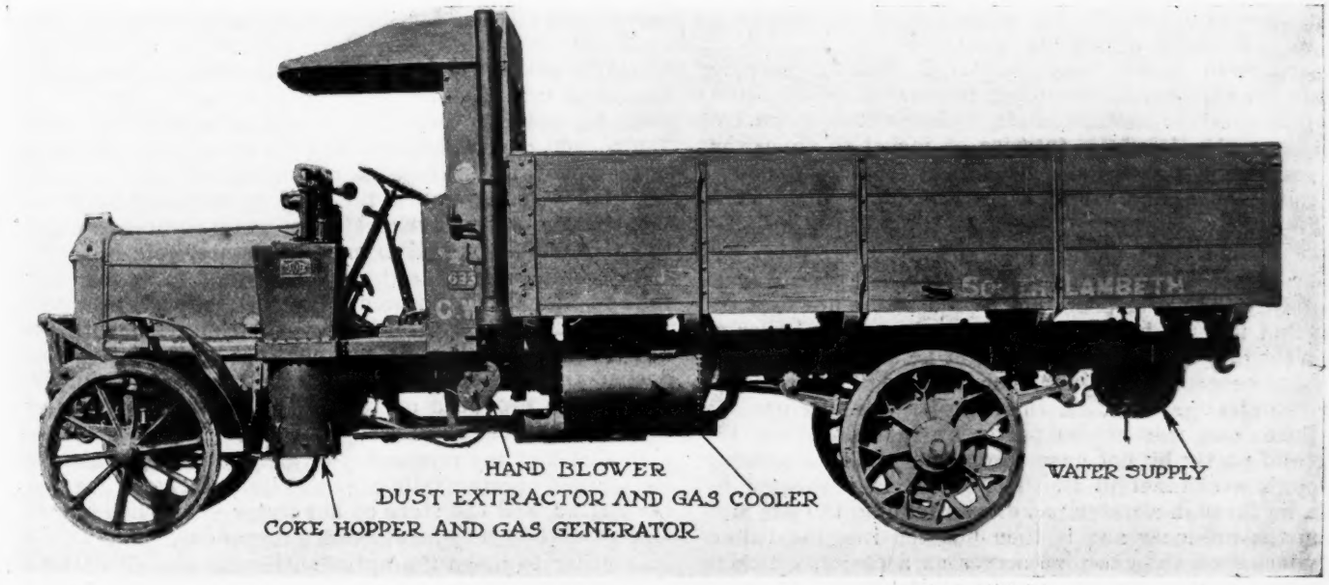
In the ordinary gas producer as used for stationary work there are four zones within the furnace—namely, the ash zone directly above the grate; the combustion zone, in which combustion of the fuel to carbon dioxide takes place; the reduction zone, in which the carbon dioxide formed in the zone immediately below combines with more carbon to form carbon monoxide, and the distillation zone, in which the volatile constituents of the fuel are driven off.

The furnace is lined with refractory material in order to withstand the exceedingly high temperature of the combustion. Fuel is added through a hopper on top, while air and steam enter at the bottom. All oxygen entering at the bottom combines with carbon in the combustion zone and there is none left to burn the volatile products formed in the distillation zone.

Smith System

The first of the English producer systems for motor truck use was developed by D. J. Smith, who read a paper on the subject before the Institution of Automobile Engineers some time ago. Most of the following information regarding this system is taken from that paper.

The basic principle of the Smith producer for motor vehicles involves elimination of all zones except the combustion and reduction zones. This has made it possible to greatly lessen the required depth of the producer. The furnace chamber is only 12 in. deep, while the fire itself is about 6 in. deep, this whole depth being incandescent while the producer is in operation. To make it possible to work on this plan it was necessary to feed the fuel continuously in small measured quantities, and to constantly agitate the whole fuel bed so that no holes can burn in it and that all ash may be constantly sifted out. This method of working eliminated trouble from

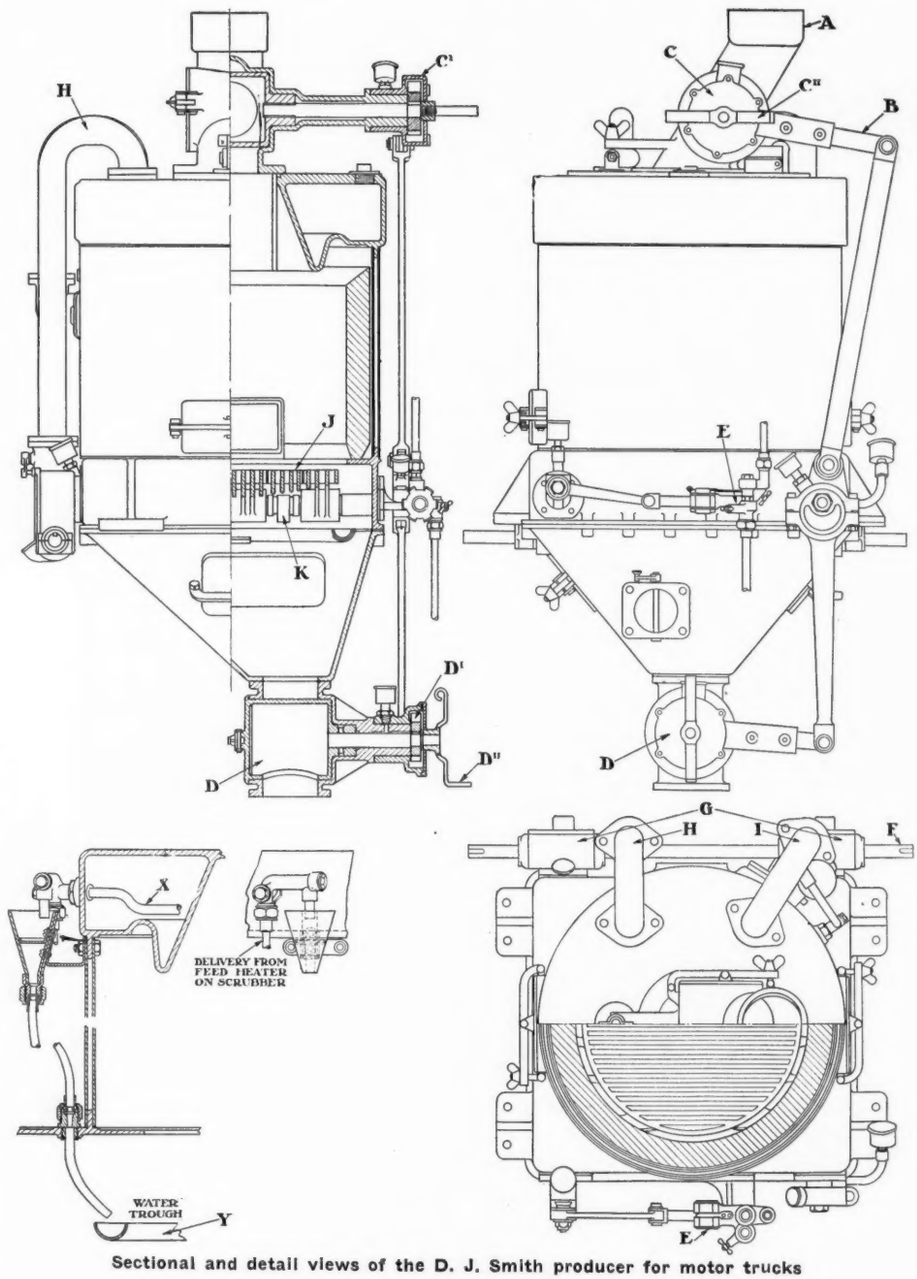


Truck fitted with Parker gas producer and auxiliary apparatus

volatile constituents, as any fresh fuel added was sifted directly into the incandescent mass of the fuel, and any part not immediately consumed was taken care of by the hot zone above the fire in the producer chamber. It is claimed that clinkering is also eliminated, because the ash is removed as fast as it forms and has no time to fuse. Both the grate and the lining of fire brick are, therefore, kept clean.

Mechanically Operated Grate

In the Smith system the feed and grate are operated by the vehicle engine, and the ash discharge is also by mechanical means. This latter feature results in two advantages: It eliminates the necessity for an ash pan sufficiently large to carry the ashes formed during several hours' running, and it also does away with the necessity for stopping the engine to remove the ashes. Sectional and outside views of the Smith producer are shown herewith. It is of upright cylindrical form with a fuel inlet and feeding mechanism on top, the fire-clay-lined combustion chamber in the middle, the grate below it, a substantially conical ash pit below the grate, an ash discharge valve at the bottom and various auxiliary devices on the outside.



Sectional and detail views of the D. J. Smith producer for motor trucks

Referring to the illustrations, A is the fuel inlet pipe; B, the adjustible fuel feed and ash discharge mechanism; C, the fuel feed valve; C′, the friction drive for the feed valve; C″, a handle for independent hand operation of the feed valve; D, ash discharge valve; D′, friction drive for ash discharge valve; D″, handle for ash discharge valve; E, water pump; F, main operating gear shaft driven direct from engine; G, driving gear for grate bar camshafts, completely inclosed and lubricated; H, pipe carrying steam and air to the bottom of the fire; I, air supply pipe from interior of jacket to vaporizer; J, grate bars pivoted at one end, alternate sections at alternate ends, and vibrated successively by camshafts.

Vaporizer

Mr. Smith found that for best results in the way of flexibility the water could not be fed to the fire directly, but had first to be converted into steam. In order to keep the quality of the gas constant he uses the air passing to the combustion chamber as a regulating means for the steam supply. A small boiler was fitted to the producer and was heated partly by radiation from the fire and partly by hot gases from the producer passing through a channel in it. The water is preheated by passing through a water jacket surrounding the gas pipe from the producer and is then pumped into the boiler. The jacket on the gas pipe serves as a cooler, which is a feature of most producer gas installations and is particularly valuable where no water is used in the scrubber, as in this case.

If the water in the boiler is kept at a temperature of 180 to 200 deg. Fahr. and the air for the producer is drawn over its surface, it picks up enough moisture for steady loads, but if the load is then suddenly increased the temperature of the water decreases, and the air, instead of getting more moisture, gets less. To remedy this condition a throttle was fitted to the air inlet to the boiler through which all of the air to the producer had to pass. This throttle was interconnected with the engine throttle in such a manner that as the latter was opened the former closed; the result is that an underpressure is produced on top of the water in the boiler and steam forms more readily.

In this way the proportion of air and steam is always maintained substantially constant irrespective of load on the engine, and the store of hot water in the boiler acts as a reserve to help meet sudden demands.

In order to make the outfit automatic a good deal of auxiliary apparatus is required. There is, first, the

water feed to the boiler which must be so regulated as to maintain a substantially uniform water level, irrespective of the inclination of the road surface. To this end, in the Smith system the delivery pipe (see detail view) is taken into the center of the boiler, where its level with respect to the water does not vary, and it is made to serve also as an overflow pipe. When the water level exceeds that desired, the water pumped is discharged into an asbestos-filled channel Y in the ash pan, where it is vaporized, and what cannot be absorbed by the asbestos is discharged through the ash valve in the bottom of the pan.

The rate at which fuel and water are consumed in the producer depends not only upon the speed but also upon the load carried by the engine, and to take account of this fact the fuel feed device and the water pump are coupled up with the engine throttle so that their strokes are reduced when the throttle is closed. This is said to have given satisfactory results, although with a fuel like coal, containing lumps of varying size, no absolute regulation of the feed is possible.

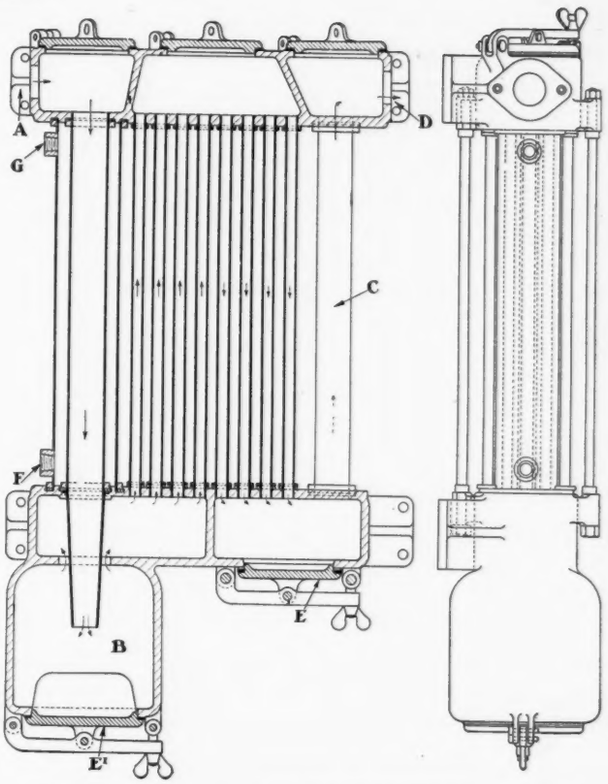
Dry Scrubber and Cooler

Smith uses a dry scrubber which merely removes particles of dust in the gas as it comes from the producer. A sectional view of this device is shown herewith. The gas enters at A, passes down a pair of large tubes at the left (which are slightly contracted at the bottom so as to increase the velocity) and is then discharged into a settling chamber B, in which most of the dust collects. The gas passes out of the settling chamber through an annular opening around the large tubes, up one series of tubes and down another, both surrounded with water, and finally passes up a pair of large tubes C on the right, containing a filter of conical shape extending the length of the tubes. Additional dust settles in the tubes, headers and filters, and it is claimed that when the gas finally passes out of the scrubber at D it is as free from dust particles as the air ordinarily taken into carbureters. Quick removable doors E and E′ are provided where most of the dust settles, and the apparatus can be easily cleaned. This scrubber also forms a feed water heater. The water from the feed pump enters the scrubber near the bottom at F and leaves through the top opening G. The material found in the filter is merely fuel dust, and it is claimed that no trace of tarry matter has ever been found. In this connection it should be noted that only hard coal or coke is used with this system; Mr. Smith anticipates that for engines with inclosed valves some further filtering may be necessary, owing to the very fine valve stem clearances.

The gas, after leaving the scrubber, can be taken through a water seal, the gas pipe from the scrubber dipping from 1 to 1½ in. into water, the level of which is maintained by a float. A small amount of water will then be carried along into the combustion chamber, but not enough to cause trouble. On farm tractors the scrubber should be so placed that it gets the benefit of the radiator fan blast, and an air washer should be fitted. The water seal or air washer should be cleaned out once a day.

The Parker System

Another system has been invented by J. W. Parker and is being placed on the market by Producer Gas Plants, Ltd. In this system use is made of a dry gas cooler and dust extractor and a wet scrubber. A demonstration of the system, fitted to a 3-ton truck, was recently given to press representatives in London. A vertical section and an elevation partly in section are shown herewith. The upper part of the producer, which is of



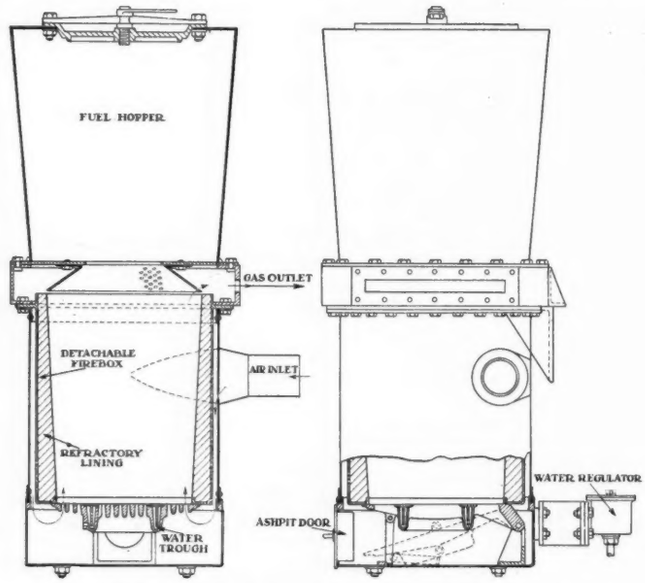
The scrubber designed for use in connection with the Smith producer

square section, forming an inverted truncated pyramid, serves as the fuel hopper and is provided with a cast iron cover held in place by cap screws. Below the hopper is a flat, rectangular gas chamber with a perforated inverted sheet metal funnel which serves to keep the fuel out of the gas main. The firebox is made up of sheet steel, is cylindrical in form and provided with a refractory lining the thickness of which increases toward the bottom. It has a mean internal diameter of 11¼ in. and a depth of 16 in. The firebox is surrounded by an outer jacket of sheet steel which is supported by the same bolts and has the ash pit fastened to it at the bottom. The grate is a single steel casting, pivoted on a cast iron bracket on the bottom of the ash pit, and held in the horizontal position by means of a strut. When it is desired to rake out the fire the ash pit door is opened and the strut pushed back, which permits the grate to be dropped to an inclined position, as indicated in one of the drawings in dotted lines.

Vaporizer in Grate

Steam for gas generation is produced by means of an annular water trough formed in the grate, into which is placed a loose ring of tee section to prevent it from becoming filled with loose ashes. This simple vaporizer is kept filled with water to a constant level by means of a float. The air for the producer is drawn through the jacket of the furnace, whereby a double object is accomplished, in that the air is preheated and the furnace wall cooled. From the jacket the air passes into the ash pit, thence through the grate and up through the bed of fuel, the gas there formed passing out through the rectangular opening at the side of the gas chamber.

A hand blower is provided for starting the producer. During the early stages of operation a mixture of air and gas is produced in all systems which is unsuitable for use in an engine and which, since it contains a good deal of poisonous carbon monoxide gas, must be carried away so it cannot be inhaled by the attendant. In the



The Parker gas producer designed for use on motor trucks

truck equipped with the Parker system this gas is carried away through a vertical chimney carried up one side of the cab and connected to the gas main between the producer and the cooler. At the bottom of the chimney there is a conical valve by means of which it can be either opened or closed to the gas main.

Gas Cooler and Dust Extractor

As already mentioned, an important feature of this system is a gas cooler and dust extractor which works on the dry principle. The upper part of the cooler is cylindrical and is fitted with a number of horizontal tubes, while the lower part is wedge-shaped. The gas enters the cooler centrally on top and first passes through the space between the outer and inner shells. It then changes its direction of motion and passes on into the space through which the tubes pass, and in doing so it deposits out the entrained dust in the lower portion of the cooler. There are plug-closed openings at both ends of this wedge-shaped part through which the accumulated dust can be removed at intervals. Air circulates through the cooling tubes, the cooler being mounted at the side of the truck so that the motion of the latter creates a natural draft through the tubes. Increased air circulation is induced by means of an air ejector connected to the end of the exhaust pipe. The outlet from the cooler is at the top, not very far from the inlet. In the 3-ton truck size the shell has an area of 10.2 sq. ft. and the tubes have an area of 7.3 sq. ft., making the total cooling area 17.5 sq. ft.

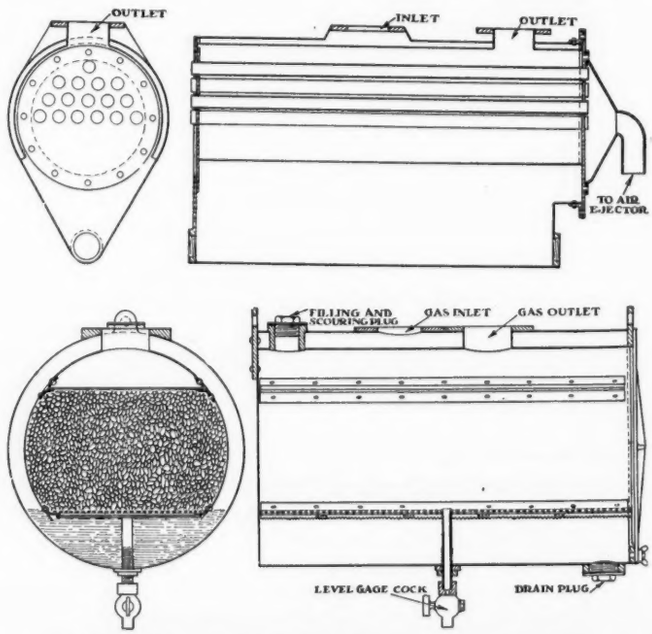
Wet Scrubber

The scrubber is not unlike the cooler in shape, and in practice is mounted on the opposite side of the truck from it. It also has both inner and outer shells, the former extending down about three-fourths the full depth. The edges of the inner shell are serrated, and to them are riveted angle irons which carry the grid plate on which the bed of pebbles is supported. These pebbles have an average diameter of ½ in. The bed of pebbles was originally made 7 in. deep, but it was found that 4 in. was all that is necessary, and this, of course, permits of a considerable saving in weight. Through an opening on top the scrubber is filled with water to the level of the bottom of the pebble bed, the level being adjusted in the first place by means of a standpipe and cock, and later maintained automatically by a float. Gas enters the scrubber on top, passes through the space between the inner and outer shells, turns the corner of the serrated edges on the inner shell in the form of bubbles and then passes up between the pebbles which are kept moist by capillary action. Any tarry matter or dust which may have passed the cooler will adhere to the pebbles. From the top of the scrubber the gas passes directly to the engine. The scrubber must be cleaned out each day, and this is conveniently accomplished by inserting a hose into the plug opening provided for the purpose on top, there being a similar opening at the bottom through which the water can run off. The pebbles must occasionally be given a more thorough cleaning, and to this end they are removed from the scrubber. To facilitate this removal they are now placed in a wire basket. When the truck runs on either an up or a down grade, part of the serrated lower edge of the inner shell will be out of the water, and then the gas does not have to bubble through the water. It has been found, however, that this does no harm, as the water retained by the pebbles is sufficient to effect the purification of the gas during these short periods.

In order to be able to adjust the mixture for maximum power, an air valve is mounted on the dashboard where it can be easily reached by the driver. This is the only adjustment required, and it is said that this adjusting valve needs to be attended to only very rarely. The hopper, of course, must be refilled with fuel at intervals. With this system, foundry coke is used as fuel; ordinary gas coke can be used in an emergency but does not give nearly as satisfactory results. The fuel is broken and screened to approximately 1 in. size.

Performance Claims

Following are some claims of performance made by the manufacturers of the Parker producer. The fuel consumption for a 3-ton truck is guaranteed not to exceed 300 lbs. for a 100 mile run under full load. About 20 U. S. gal. of gasoline would be required for the same work. The saving in fuel cost can therefore be easily calculated if the prices of gasoline and coke are known. Mention is made by the firm of the possibility of increasing the compression pressure, and thus further



Above, the gas cooler and below, the wet scrubber designed for use in connection with the Parker gas producer

reducing the fuel consumption, but in this connection it must be borne in mind that this would increase the starting difficulty, as the effort required to crank an engine increases substantially with the compression pressure. On the other hand, as the fuel is always in the gaseous state, the engine should pick up its cycle almost immediately.

Water is used in both the producer and scrubber, and the supply must be replenished occasionally, but the consumption is quite small and the attention required by the water supply is not irksome. About 25 gallons is carried, and the former gasoline tank is usually made to serve the purpose. This supply will last for a week's work. The only wearing part of the outfit is the fire box, which lasts about 6 months. Fire boxes are not relined, but new ones are supplied complete, and their installation is said to be a matter of a few minutes. The cost of the renewal is not high.

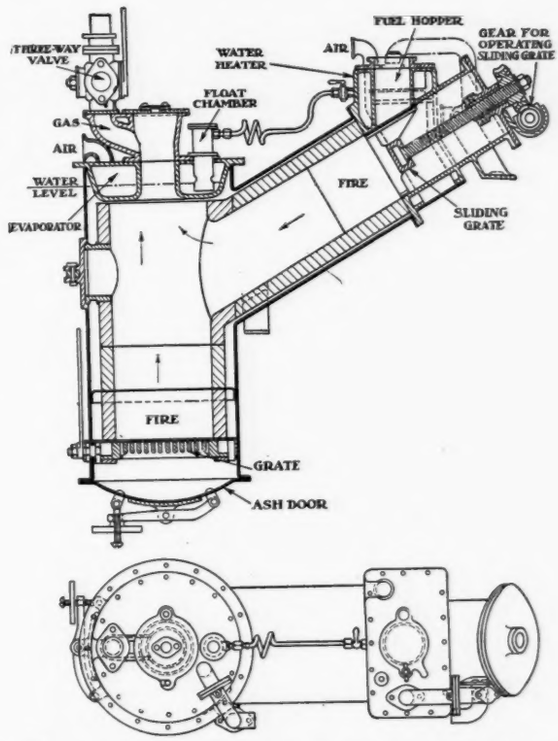
Stewart System

The ordinary producer as represented by the two systems described is known as the up draught system. In order to more effectively dispose of the volatile constituents, the experiment was tried of inverting the process, drawing the air in at the top of the producer and the gas off at the bottom, this giving what is known as the down draught system. In this case, as additional fuel is fed, the volatile products are drawn into the combustion zone and are consumed along with the fixed carbon of the coke. The difficulty with this system is that eventually the fire descends so low that the air cannot get to it any more on account of the intervening layer of ashes, and the ashes even get close to the gas outlet. A compromise or intermediate system has been developed by John Stewart and described by him in a paper read before the Scottish Section of the Institution of Automobile Engineers. The producer comprises two chambers, one vertical and the other, in direct communication therewith, extending up at an angle. The angle chamber is a down draft chamber and the vertical chamber an up draft chamber. Fuel is added at the outer end of the angle chamber through a hopper. Air is supplied at the same point, also water vapor, the vaporizer being located on top of the vertical chamber. When a fresh charge of fuel is added it falls behind the fire, and as the air must be drawn through this fuel there is always air present when the volatile products are driven off. The result is that the volatile elements burn at once. Even if this should not be the case the volatile products would have to pass through the fire zone, where they could not help being burned, in part to carbon dioxide, which would later be reduced to carbon monoxide.

Functions of the Two Fire Chambers

In this system the vertical chamber serves the same function as in an ordinary up-draft system, but the fuel in this case is fed through the hopper on top of the angle chamber. This obviates the difficulty (experienced with ordinary up draft producers when adding fuel while running) of the tarry material getting into the gas stream and clogging up engine parts.

For the removal of the ashes there is a grate swung on trunnions, which is operated by a vertical lever at the side. By shaking the grate the ash is transferred to the saucer-shaped ash container at the bottom. At the center of this ash container there is a small hinged door through which the ashes can be dropped out at the end of a day's run. By operating the vertical handle on the grate to and fro through a sufficient angle, the bed of fuel can be consolidated at intervals.



The Stewart gas producer, of the semi-down-draft type, for motor truck application

Arrangement of Evaporator

At the top of the vertical chamber there is an evaporator in which the water is maintained at a depth of 1½ in. This evaporator has a sheet copper cover to which the angle fittings for the air inlet and outlet are brazed. Within the air outlet pipe close to the cover is fitted a small throttle valve which is closed during the fanning operation. The gas outlet from the up-draft chamber is arranged centrally. When the producer is started up from cold, fuel can be fed through this gas outlet. There is a three-way valve on the gas outlet and the gas can either be passed to the engine or allowed to escape to the atmosphere. The feed of water to the evaporator is regulated by means of a float valve. Jolting of the vehicle is said to have no influence on the level of the water in the vaporizer. With a constant water level in the evaporator the air passing through will absorb a constant proportion of steam. It has been found, however, that the amount of moisture originally provided for was not sufficient for best results, and provision is now made for an additional drip feed on the air pipe.

The head of the angle chamber is a water-jacketed casting and is extended to form a water preheater, water being fed from this preheater to the evaporator and to the drip feed on the air pipe. This chamber is provided with a sliding grate which pushes the fuel in as required, and by its withdrawal permits additional fuel to fall in, there being a projecting wing which laps the port hole in its forward position. The sliding grate is operated by a worm and wheel carried by the cover of the angle chamber.

All of the producer systems here described are designed for use of only hard coal or coke. Soft coal is generally cheaper and more easily obtained in most localities, but the large proportion of tarry products render it unsuitable for use in automotive gas producers where the weight, space and complication of adequate cleaning apparatus present problems which are not easily solved.

Gearing Calculations by the Compressive Stress Method

Part I

The capacity of gears cannot be accurately determined by the bending stress method for bending stresses are not a true measure of wearing qualities. The maximum surface pressure, or compressive stress, must be considered if rate of wear of tooth is to be kept within proper limits.

By Joseph Jandasek*

WITH the exception of the engine, the gears are the most important part of an automotive vehicle. Designing gears so that they can be economically manufactured and at the same time will withstand long-continued wear is by no means a simple problem, and the designer seldom obtains the results he desires on his first attempt.

To determine the capacity of gears on the basis of bending stresses is more or less guesswork, because the bending stresses are only only an approximate and not a rational measure of wear resistance. In some cases, such as that of helical gearing, this method cannot be used at all. By the bending stress method the resistance of gears to fracture can be calculated; the compressive stress method, on the contrary, permits of determining the capacity of gears from the standpoint of wear; it is accurate and can be applied to any type of gear, because the radii of tooth curvature are always known.

Referring to Fig. 1, a gear can be made either of small width and cut with coarse pitch teeth, or of great width and cut with the finer pitch teeth, the diameter being maintained constant and the bending stresses remaining practically the same. We know, however, that a narrow gear will not stand up to heavy work. It has been proved in practice that in the case of helical spur gears considerations of wear so much outweigh those of mere breaking strength that a gear which is designed to give reasonably long service will carry anywhere from 10 to 20 times the working load without fracture.

In addition to the quality of material and the friction coefficient, the number of teeth and the tooth action are very important factors. The proportion of rolling to sliding motion and the proportions of tooth elements, such as the addenda of the gear and the pinion, also have great influence on the life of the gears; however, in the following discussion the writer will assume that the addenda and the ratio of rolling to sliding motion have optimum values.

*Engineer, Republic Motor Truck Co., Inc.

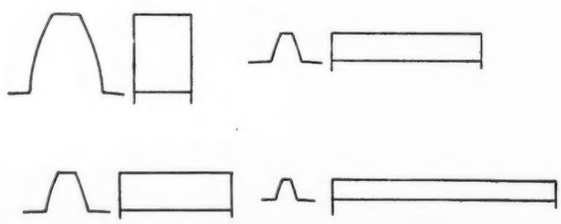


Fig. 1—Teeth of equal strength according to the bending stress method of calculation

In the case of motor vehicle rear axles, especially those of trucks and tractors, where heavy tangential forces are being transmitted most of the time, the necessary size of

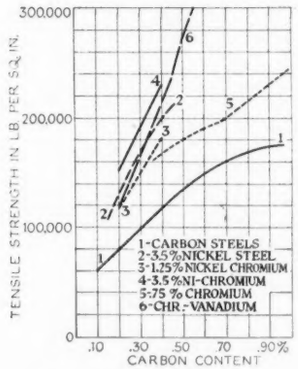


Fig. 2 — Relation between carbon content and tensile strength in steels

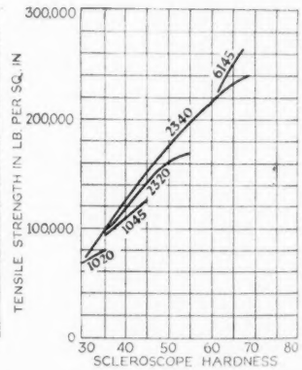


Fig. 3 — Relation between scleroscope hardness and tensile strength in steels

the gears must be determined by a method which gives assurance that the tooth faces will withstand the abrading action due to the rolling and sliding motion for a sufficient length of time. This wearing quality depends on the maximum tooth face pressure, assuming that the quality of material, toughness, proportion of rolling to sliding motion, friction coefficient and tooth action are the same. The allowable tooth face pressure depends, in turn, on the ultimate strength of material, which strength finally bears a definite proportion to the hardness. The designer, therefore, always specifies the hardness number in order to obtain the desired resistance to wear.

That certain materials do not wear away quickly is due to two conditions:

(*a*) particles on the surface are not readily displaced;

(*b*) particles, though displaced, are not readily removed.

Both these conditions must be present; either one alone is not sufficient. Substances which are really hard do not permit of their particles being readily displaced—hence they wear well. Plastic metals do not permit of their displaced particles being readily removed—hence they, too, may give good wearing surfaces though they are soft and compressed above the ultimate compressive strength. We find a good example in manganese steel, whose good wearing quality appears to be due to the following two

causes: (1) the relatively high natural hardness (though less than that of hardened steel); (2) surface particles which are displaced are not ground to powder, the surfaces being merely plastically deformed. Thus the particles are capable of being displaced repeatedly before being ultimately lost. This is the author's explanation of why the gear face does not necessarily show wear even if the surface pressure (in case of shock) sometimes exceeds the ultimate strength of the metal. The particles then are only displaced, but not worn off. The area and depth of metal subjected to this overstrain are exceedingly small. A similar case occurs in ball bearings, where the compressive stresses often are beyond the elastic limit of the material, yet the bearings wear well, because this overstrain is confined to an extremely small surface and a small depth; moreover, the over-compressed material is supported from all sides by surrounding material.

TABLE I

Material of Gear		Speed of Pitch Circle, Ft. Per Min. 100	200	300	600	900	1,200	1,800	2,400
Cast Iron	S =	8,000	6,000	4,800	4,000	3,000	2,400	2,000	1,700
Cast Iron	C =	55,000	47,000	42,000	39,000	33,000	30,000	27,000	25,000
Cast Steel	S =	20,000	15,000	12,000	10,000	7,500	6,000	5,000	4,300
Forged Steel	S =	25,000	20,000	16,000	13,000	10,000	7,500	6,300	5,400
Bronze	S =	12,000	9,000	7,000	6,000	4,500	3,600	3,000	2,500

TABLE II

Steel: S.A.E. No.	Tensile Str. Thousands Lb.	Elastic Limit Thousands Lb.	Red. Area Per Cent	Elongation Per Cent
.20 Carbon Steel No. 1020	60	35	55	20
.45 Carbon Steel No. 1045	120	80	35	13
3.5% Nickel Steel No. 2320	130	95	50	16
3.5% Nickel Steel No. 2345	190	170	45	12
1.25% Nickel Chromium No. 3120	110	80	45	20
1.25% Nickel Chromium No. 3140	180	130	40	16
3.5% Nickel Chromium No. 3320	150	110	45	20
3.5% Nickel Chromium No. 3340	230	170	40	16
Chromium Vanadium No. 6145	240	180	35	11

This relation of hardness (in combination with toughness of material) to wearing quality explains the great success of casehardened gears. They possess a very hard and strong case, but contain a soft core of comparatively lower strength. The percentage of carbon contained in the casehardened surface should not be too great, however. A case containing 1.1 per cent of carbon gives a very hard wearing surface suitable for shafts, for instance. For gears which must withstand repeated shocks, this amount of carbon would render them too brittle, and it is advisable not to go higher than 0.90 per cent.

To illustrate the influence of carbon content on the ultimate strength the author has drawn the chart Fig. 2. It shows that the ultimate tensile strength of 0.90 per cent carbon steel, properly heat treated, is about 175,000 lb. per sq. in., while that of nickel-chromium and chromium-vanadium steel is up around 300,000 lb. per sq. in. Fig. 3 shows the influence of carbon content and hardness on the ultimate strength. It is to be noted that Brinell readings taken on casehardened surfaces are not dependable, owing to the soft core under the case, and it is advisable to use the scleroscope reading.

Now, the designer in calculating the bending stresses takes into consideration only the low carbon core, hence the design is sure to provide ample strength, because the case, which is under very high compressive stresses, is also much stronger than the core. The case is similar with cast iron, which possesses only moderate tensile breaking strength (about 40,000 lb. per sq. in.), but a much higher compressive strength (around 110,000 lb. per sq. in.).

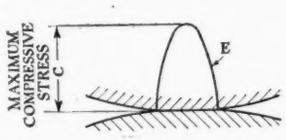


Fig. 4—Curve of compressive pressures at contact between two cylinders pressed together

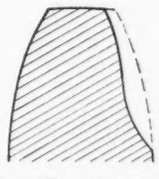


Fig. 17 — Showing how wear changes the involute tooth outline to a cycloidal outline

Soft steel gears, though the material possesses fairly high tensile strength, are not successful, because their tooth faces wear out in a short time.

The size of gears should be determined from the stresses on the working and wearing surfaces, i. e., the tooth faces. A strong pitch does not help any if the tooth wears out its face. It is the tooth contact surface, determined by the curvatures of the gear and pinion, and the face of the gears, over which the load is distributed, and the pitch should be made only sufficient to resist fracture. Any larger pitch than that is uneconomical, as there is no gain in power transmitting capacity. Regarding this influence of coarse pitch, it may be said that the deeper case hardening of coarser pitch gears slightly increases the power transmitting capacity of the gears, but this depth can vary only within narrow limits (the writer uses 1/32 in. depth of case for 6 pitch gears, 3/64 in. depth for 4 pitch gears and 1/16 in. depth for 3 pitch gears). Thus the influence of pitch is only small and beyond calculation, at least within limits of gear sizes used on automotive vehicles. It has been the writer's experience that there is no intermediate range of life; the case on the gear teeth either stands up well and the gears are long-lived, or the surfaces wear out quickly and the gears are unsatisfactory.

Thus it is not the amount of wear in a definite time, but the maximum surface pressure which we want to make the basis of our calculation. If we keep the compressive stresses below a certain value the gears will wear well, while if they are allowed to exceed this value the gears will wear out quickly.

Another example in support of this theory is furnished by tempered gears. When calculating same by the bending stress method we soon find that we must use lower bending stress than for casehardened gears, although we know that the tempered steel is considerably stronger than the soft core of the case hardened tooth (see Table II). Another light is thrown on this subject by the sketch Fig. 17. This shows how the involute tooth wears out and changes to cycloidal form simply because in cycloidal gearing the internal curve always contacts with the external one (whereas in involute gears the external curve contacts with an external one) thus securing better contact and producing lower surface stresses. This also explains why noiseless operation is obtained with involute gears only when the gears are newly cut. Even slight wear of the gear teeth causes them to lose their correct shape. Thus we reach the conclusion that it is not the bending stress in the tooth, but the compressive stress on the tooth face that determines the capacity of gears.

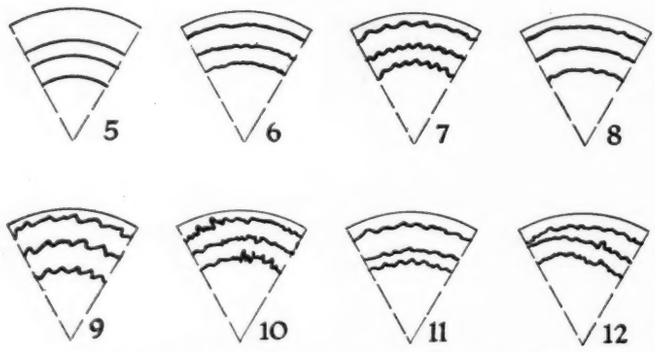
Influence of Speed on Strength of Gears

As regards the increment load due to minute accelerations and retardations of the applied tangential force, the writer assumes this to be proportional to the square of the velocity V and takes:

$$\text{Increment Load} = \left(\frac{V}{1000}\right)^2 \text{lb. per lb. of } W_c \text{ (steady load)}$$

Then the total instantaneous load W_c is

$$W_i = W_c\left[1+\left(\frac{V}{1000}\right)^2\right] \text{lb.} \quad \ldots\ldots\ldots (1)$$



Figs. 5 to 12—Showing how acceleration and retardation of driven gears are caused by irregularity in the shape of the gear

Fig. 5—Rolling action diagram of an absolutely accurate pair of gears made of rigid material

Figs. 6 and 7—Gears made with same cutter on good and badly worn machine respectively

Figs. 8 and 9—Records of gears cut in the same machine with accurate and inaccurate cutters respectively. Fig. 10—Heat-treated gears

Fig. 11—Noisy gears. Fig. 12—Noisy gears inaccurately mounted

(for accurate teeth, high grade workmanship and good material).

This increment load is an instantaneous pressure created by

(1) accelerations and retardations of the applied load and gear mass due to (*a*) irregularity of tooth outline, (*b*) variable gear tooth and its surface deflection, (*c*) wear of teeth;

(2) any acceleration, retardation, deflection and shock resulting in oscillations which at high speed may interfere and may cause the original load to be multiplied several times.

Although no correct equation for the calculation of the influence of speed is known, the writer is inclined to compute the instantaneous load by equation (1) rather than by Barth's addition $\left(1+\frac{V}{600}\right)$ for the following reasons:

(*a*) It can be proved mathematically that the increment load due to irregularity of motion must be proportional to the square of the pitch velocity and cannot be directly proportional to it. No gears are safe at extremely high speeds, hence the increment load must increase faster than the velocity.

(*b*) The mass or weight of gears subject to acceleration and oscillation increases with the transmitted load W_c; the greater the tangential force the heavier the gears required for its transmission.

(*c*) Finally, the deflection also increases with the load.

The quantities which are uncertain are the error in pitch line velocity and magnification of same by oscillation and deflection. These factors must be estimated from experiments and from the results of practice. It would be best to use different allowable stresses C or S for each particular speed, which stresses have been proved safe by actual service.

One of the most important and difficult problems in the production of automotive gears in large quantities is to obtain the high degree of accuracy required. A minute departure of the cutter from the theoretical profile, slight wear or an error of setting in the gear cutting machine results in inaccuracy of the theoretical tooth outline. It is therefore important to know not only how much the actual shape of the gear departs from the theoretical one, but also to find out the causes of these errors so they can be remedied, and breakage or extreme wear of the teeth prevented.

The author has prepared a few diagrams to show how acceleration and retardation of the driven gear are caused by irregularity in the shape of the gear. Fig. 5 (arc of a circle) is a purely theoretical diagram corresponding to an absolutely correct pair of gears. Fig. 6 is a record of another pair of gears produced by a cutter of average accuracy on a machine of the same quality. Fig. 7 represents a record of a pair of gears from the same cutter as used for the gears of Fig. 6, but cut on a worn-out machine. In this way the accuracy of the machine can be tested. Figs. 8 and 9 have been prepared to demonstrate the accuracy of cutters. Both pairs of gears were cut on the same accurate machine, but with different cutters. Fig. 9 illustrates plainly that the shape of cutter was not correct. Fig 10 illustrates the effect of hardening on the shape of gear teeth; the sharp irregularities are the result of warpage during heat treatment, and in this way badly warped gears can be easily detected. Figs. 11 and 12 are records of two pairs of noisy gears.

The above diagrams show plainly that even accurately manufactured gears possess irregularities in action, causing accelerations and retardations of the driven gear; these accelerations result in noise at high speeds and eventually breakage of the gears at some still higher speed.

Fig. 13 shows how the speed affects the allowable bending stresses according to text books on gearing. This comparison has to be taken as rather of a qualitative than quantitative character; that is, the reader's attention should be directed to the slope of the curves at different speeds. Curve *A* is a plot of the working stress (bending stress) for cast iron in the Lewis formula (see also Table I). Curve *B* represents working stresses for steel in the same formula. Curve *C* shows allowable unit stresses in carbon steel or low carbon alloy steel, casehardened, to be used for motor truck change gears, as given in P. M. Heldt's "The Gasoline Automobile." Curve *D* represents allowable unit stresses in alloy steel gears, casehardened, when used for passenger car change speed gears, given also in the above mentioned book. In Curve *E* are shown allowable unit stresses in chrome nickel and chrome vanadium steel gears, hardened all through, as given by the same author. Curves *F* and *G* give working stresses calculated from equation (1):

$$\text{instantaneous stress } S_i = S_c \Big/ \left[1+\left(\frac{V}{1000}\right)^2\right]$$

when S = 40,000 lb. per sq. in. and 25,000 lb. per sq. in. respectively. Finally, curve *K* represents the safe shear-

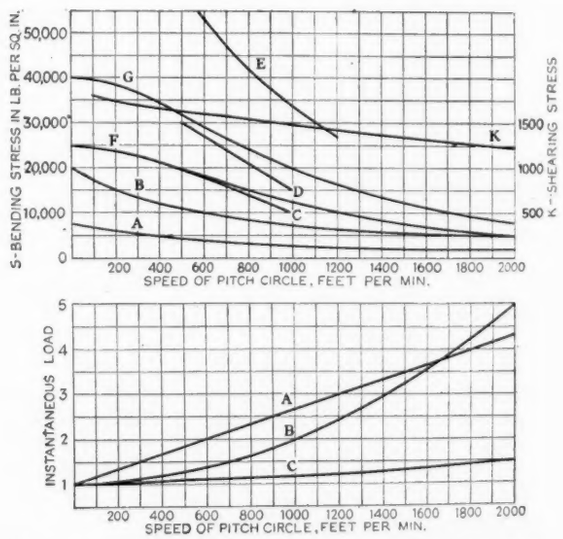


Fig. 13 (Above)—Variation of permissible bending stress in teeth with pitch circle speed according to different authorities

Fig. 14 (Below)—Variation of instantaneous load with pitch line velocity according to various formula

ing stress in lb. per sq. in. for herringbone gears of high carbon forged steel (see also Table III) as used in the equation for the capacity of this type of gearing.

$$W = 0.4\ p\ f\ k \quad \ldots\ldots (2)$$

Fig. 14 represents the two equations for increment load. Curve *A* gives the instantaneous load according to Barth's equation:

$$W_i = W_b\left(1 + \frac{V}{600}\right) \quad \ldots\ldots (3)$$

This formula is suitable only for cast and inaccurately cut gears and low speeds. Curve *B* represents the instantaneous load according to equation (1). Curve *C* shows the instantaneous load for herringbone gears for high carbon steel. The slow increase of the increment load brings out clearly the advantage of helically cut gears.

Capacity of Spur Gears

Starting from the theory of pressure between elastic bodies with curved surfaces we can calculate the load capacity of straight spur gears according to the general equation:

$$W_c = \frac{\sin 2\Theta}{0.7}\left[\frac{1}{e} + \frac{1}{E}\right]\frac{C^2 f r}{1 + \frac{r}{R}} \text{ lb. per sq in.} \quad \ldots\ldots (4)$$

(This equation differs slightly from the one derived on page 1405 of AUTOMOTIVE INDUSTRIES for June 17, 1920.) In this equation

W_c = maximum safe tangential force as regards the compressive stress at the pitch diameter, assuming that only one pair of teeth is in mesh at a time:

Θ = pressure angle in degrees.

e and E = moduli of elasticity of materials in contact: lb. per sq. in.

C = maximum allowable compressive stress on the tooth face at the pitch line in lb. per sq. in. for each particular speed V.

(In Fig. 4 is shown the distribution of pressure between two cylinders. It is the very maximum and not the average pressure which we are dealing with.)

f = face of gears in contact in in.

r = pitch radius of pinion in in., R = pitch radius of gear in in.

V = circumferential speed at the pitch line in ft. per min.

Although the compressive stress C is the same for the gear as for the pinion, still the pinion will wear more rapidly, provided hardness and toughness are the same, because the teeth of the pinion come into action more frequently. Also, if there occurs any overstrain due to shocks more metal is deformed on the pinion than on the gear, owing to the smaller radius of tooth curvature. However, it is desirable that pinion and gear should wear equally long, so as to avoid the necessity of engaging a new pinion with a partly worn gear, thereby decreasing the life of both. Consequently, to secure equal wear in a pair of unequal gears the pinion should be made harder (from 5 to 10 points scleroscope) than the gear. This applies, in the case of internal gear-driven axles, to the bevel gears, and in the case of double reduction axles to the bevels and spurs. In the case of internal gears the pinion is usually made of better steel (3½ per cent nickel as compared with carbon steel for the gear).

Inserting the modulus of elasticity E, whose average value may be taken at 30×10^6 lb. per sq. in., in equation (4) we obtain for straight spur gears, steel on steel, with a pressure angle $\Theta = 20$ deg. the capacity:

$$W_c = \frac{C^2}{16.3 \times 10^6}\,\frac{fr}{1 + \frac{r}{R}} \quad \ldots\ldots (5)$$

We have, further,

$$2\pi r = np \qquad \text{and} \qquad \frac{r}{R} = a,$$

hence we get for the capacity,

$$W_c = 10^{-5}\, C^2\, pf\,\frac{n}{1+a} \text{ lbs. per sq. in.} \quad \ldots\ldots (6)$$

(for steel spur gears with a pressure angle of 20 deg.), where n = number of teeth in pinion.

p = circular pitch in inches.

The value of the gear ratio $a = r/R$ must be added for external and subtracted for internal gears.

From this equation the reader can readily see that the capacity of a pinion depends not only on its own dimensions, but also on those of its mating gear. The case is similar to that of ball bearings whose capacity depends not only on the ball diameter, but also on the size and shape of the races.

TABLE III
SAFE SHEARING STRESS K FOR HERRINGBONE GEARS

Gear Material	Velocity in Feet Per Minute													
	100	200	300	400	500	600	800	1000	1200	1500	1800	2100	2400	3000
Brass	600	575	550	525	500	475	425	400	380	360	350	340	325	300
Cast Iron	800	750	700	675	650	625	575	525	500	475	450	425	400	375
Gun Metal	1000	950	900	860	830	800	750	700	650	600	550	525	500	475
Phosphor Bronze	1150	1100	1060	1030	1000	975	925	875	825	775	725	675	650	600
Steel Castings	1325	1275	1250	1200	1175	1150	1100	1050	1000	925	875	825	775	700
High Carbon Steel Forgings	1800	1750	1700	1660	1630	1600	1550	1500	1450	1350	1275	1200	1125	1050

On the basis of bending stresses the strength of spur gears,

$$W_b = Spfy \text{ lbs. per sq. in.} \quad \ldots\ldots (7)$$

The strength of a pinion calculated on the basis of bending stresses depends on its own dimensions only and remains the same whether a pinion meshes with a spur gear, a rack or an internal gear of any size.

To simplify matters we may take for the tooth form factor for the Fellows stub tooth system the value

$$y_s = 1.25\left[0.154 - \frac{0.912}{n}\right] \quad \ldots\ldots (8)$$

(*To be continued*)

WITH a view of proving that the metal can be safely employed for many purposes which appeared at one time beyond its scope the French Société d'Encouragement recently organized an "aluminum week," during which an exhibition was held at the society's headquarters in the Rue de Rennes, Paris, accompanied by conferences dealing with the various applications of the metal. The exhibition itself covered almost every application, and particularly interesting were aluminum castings of so complicated a character that it would be difficult to obtain equally good results with other metals. So much progress has been made with the welding of aluminum and the production of alloys that it is now capable of being employed for almost every purpose, even where it is subjected to heavy stresses, and the addresses delivered by L. Guillet and others aimed at showing that aluminum has a vast field of utility in electrical engineering as well as in the aviation, motor car and other industries.

The Influence of Various Fuels on Engine Performance

Part VII

In this, the concluding article of this series, the author describes the variable compression and other engines employed in conducting the tests and the considerations on which the design of some of these was based. The testing apparatus used is also described and illustrated.

By H. R. Ricardo*

IT is well to point out that in the results of tests reported in foregoing instalments of this article in all cases where a result was obtained which did not at first sight appear to fall into line with the deductions formed at the time, check tests were taken progressively throughout the whole series of variables until the particular one had been traced whose influence was exerting itself. Except in a few instances where samples were very difficult to obtain, and only very small quantities were available, all the results quoted in the previous articles were checked again and again, and no figures have been published which have not been checked and repeated to within ±0.5 per cent at least two or three times. In order that the reader may have the opportunity to judge for himself as to the accuracy of the readings obtained, and to draw his own conclusions as to the nature and possible influence of such disturbing factors as may remain, and which might affect the results, it will be well to describe in some detail the apparatus used.

*From a preliminary report (slightly condensed) on research work conducted by the author for the Asiatic Petroleum Co. and published in the *Automobile Engineer*.

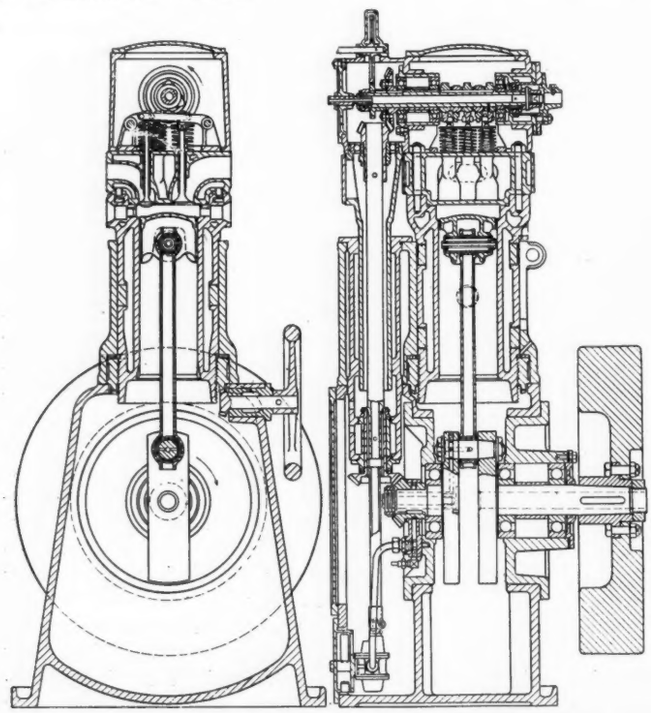


Fig 27—Sectional views of the variable compression engine

In Figs. 27 and 28 are shown a drawing and a photograph of the variable compression engine. In the design of this engine the following considerations were taken into account.

(1) In view of the prolonged and extensive nature of the tests, not only were durability and reliability regarded as matters of primary importance, but every effort was made to insure mechanical consistency.

(2) Every known expedient was adopted to attain the highest possible thermal efficiency and power output and to insure that all losses, whether thermal or frictional, were reduced to the absolute minimum, and maintained as nearly constant as possible under all conditions.

(3) The engine was designed to run when required at a piston speed in excess of that of existing engines.

(4) Means were provided for varying the compression of the engine over any range from 3.7:1 up to 8:1 while running at full power, and without disturbing any temperature, frictional, mechanical, or other conditions.

(5) The combustion chamber was so designed that its general form and ratio of surface to volume undergo the minimum of alteration when the compression is varied.

(6) Special means were adopted to render the engine as little sensitive to changes in the temperature of the lubricant as possible. Ball bearings are used wherever possible, in order to reduce variation in friction with different oil temperatures, and the water jacketing round the barrel of the cylinder is stagnant, and therefore quickly attains a constant temperature, independent of the temperature of the supply. This insures that the piston friction which is dependent upon the temperature of the oil on the cylinder walls reaches a minimum in the course of a few minutes, and thereafter remains constant. The importance of retaining the same general form of combustion chamber under all conditions of compression cannot be over-estimated. Very misleading results have been obtained when the compression ratio has been varied by fitting different pistons, some with concave, others with convex crowns. In one series of experiments with different compression ratios which the writer examined, and which were obviously carried out with the most scrupulous care, the results were entirely vitiated because the whole character and efficiency of the combustion chamber was completely changed, as between the low compression and the high, with the result that a certain optimum compression ratio was claimed to have been found, after which any further increase in com-

pression resulted in loss of power and efficiency. A careful scrutiny of the results showed that at or near the so-called optimum compression ratio the efficiency of the combustion chamber was at a maximum, and that at the higher compressions it fell away very rapidly, and, indeed, became quite exceptionally inefficient.

In the variable compression engine designed for the purpose of these tests the efficiency of the combustion chamber undergoes very little change between the lowest compression ratio and the highest, with the result that the efficiency increases with increase of compression at a perfectly normal rate throughout the whole range.

As will be seen from the sectional drawings, Fig. 27, the compression ratio is varied by raising or lowering the whole cylinder, together with the carbureter, camshaft, and valve gear; by this means the compression ratio can be varied over any range in the course of a few seconds, and without disturbing any of the temperature conditions or any adjustments.

To measure and record the compression ratio in use a micrometer is provided. This is arranged to operate electrical contacts, and controls a pilot lamp which lights up immediately the desired compression is reached, so that the operator can adjust the micrometer screw at his leisure to the compression ratio he requires before making any alteration, and can then see at a glance by the lighting up of the lamp that this compression has been reached.

For the ignition of the charge four spark plugs are fitted equidistant round the circumference of the combustion chamber, each of which is connected to a Remy high tension coil. The low-tension circuit of all the coils is operated by a single Remy contact breaker driven directly from one end of the camshaft. The object of using this arrangement in preference to magnetos was twofold:—

(1) To insure that the passage of the spark across all four plugs should be absolutely synchronous.

(2) To insure that the intensity of the spark should be the same at all settings.

In practice it was found that the use of two sparking plugs on opposite sides of the combustion space gave equally good results, and all tests were therefore run under these conditions. To measure accurately both the power and friction losses the engine is direct coupled to a balanced swinging field electric dynamometer, one arm of which carries a dead weight of 40 lb., which is slightly in excess of the maximum torque of the engine—a light open-scale spring balance is used to record the difference in torque between the dead weight and that developed by the engine—this arrangement permits of exceedingly accurate determinations, since a very small variation in torque corresponds with a wide range on the spring balance. The mean torque on the dynamometer arm is in the neighborhood of 35 lb., and the difference can be read off at a glance to within less than one-tenth of a pound. The steadiness of the dynamometer is such that the needle of the spring balance does not vibrate or oscillate through a range of more than ± 0.1 lb. Generally speaking, all readings of torque can be taken as being accurate to within one-third of one per cent., while the standard of accuracy of the average of several readings is, of course, considerably higher. The load is controlled by varying the field excitation of the dynamometer. For this purpose, two rheostats are provided in the field circuit, one of which gives coarse graduations, and the other, a continuous coil resistance, affords continuous range, and is used for fine adjustments.

The fuel-measuring device consists of two vessels, each consisting of two conical ended chambers connected together at either end by a narrow throat as shown in the general layout of the testing apparatus, Fig. 29. The upper chamber has a capacity of exactly one pint, and the lower of ¼ pint. A gage glass is fitted to each vessel. The

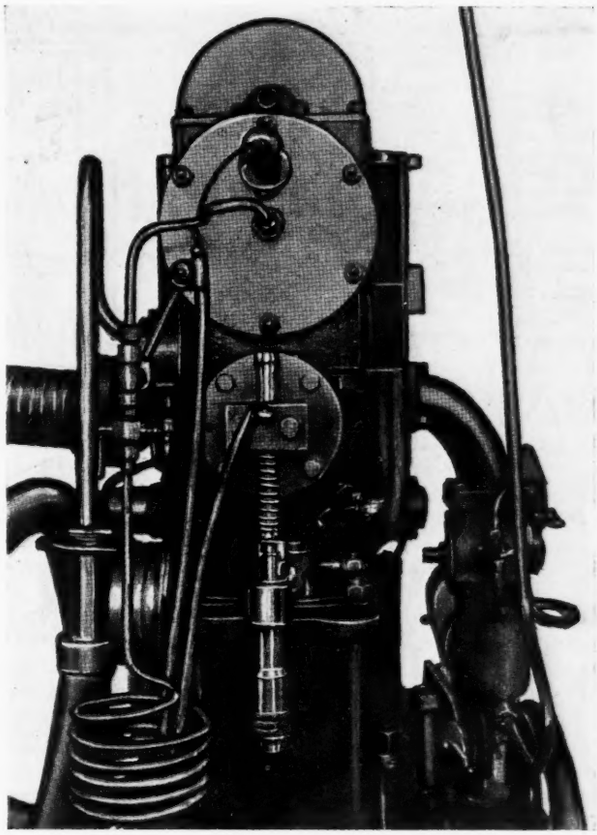


Fig. 28—Variable compression engine showing the micrometer for adjustment of the cylinder to various compression ratios

rate of fall of liquid in the glass is very rapid when passing the narrow throats, so that its passage past the marks can be timed with extreme accuracy. Geared off one end of the camshaft is a revolution counter operated by means of a magnetic clutch, and so arranged that the counter is thrown into operation as the liquid in the gage glass passes the first mark, and is thrown out, and a brake applied to its spindle as the liquid passes the second mark; thus the actual number of revolutions during the consumption of either one pint or one quarter pint of fuel is automatically recorded.

The carbureter is a standard Claudel-Hobson aircraft type, but fitted with a fine adjustment needle valve controlling the jet so that the mixture can be varied between close limits. An electrical heater is fitted in the carbureter air intake passage, and the exact amount of heat supplied can be read off from instruments on the switchboard. A thermometer fitted in an insulated pocket, and projecting into the inlet valve port, is provided to record very approximately the temperature of the working fluid during its entry to the cylinder. From the known amount of heat supplied, and from the measured difference in the temperature of the air before and after its entry to the carbureter, it is possible to determine at least a relative measure of the mean volatility of the fuel used. As has been explained previously, the readings of the thermometer in the induction passage are of relative value only. Owing to the variations in the temperature of the thermometer pocket due to the deposition of liquid fuel upon it this thermometer behaves as a wet bulb instrument, and even the relative values of its readings cannot be relied upon as between fuels of widely different latent heats of evaporation.

From the above details it will be seen that the standard of accuracy obtainable with this particular piece of appa-

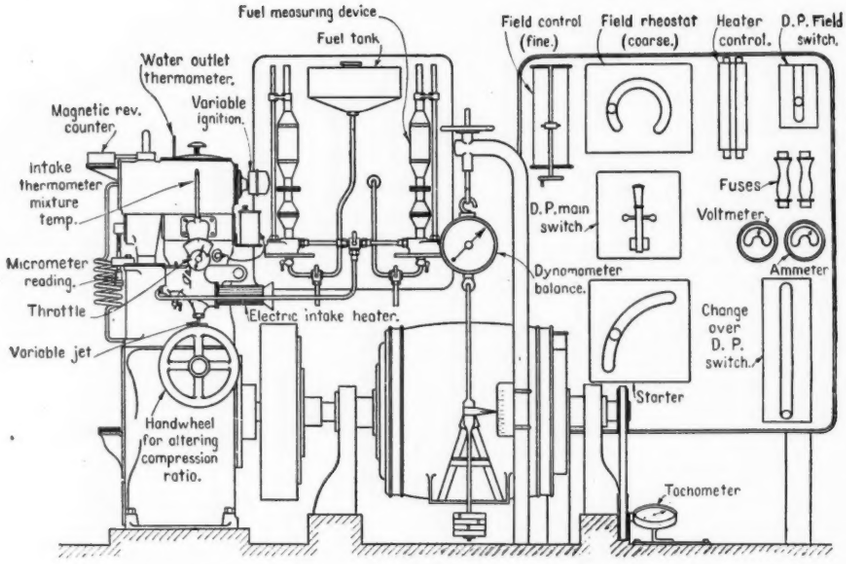


Fig. 29—General (diagrammatic) layout of the testing apparatus

ratus is exceedingly high; its mechanical consistency is exemplified by the fact that many check tests of power and consumption taken on certain fuels, sometimes after a lapse of many months, show extreme variations of less than 0.5 per cent.

This particular engine has been in almost continuous operation for 20 months, running on the average some 10 to 15 hours per week, about 90 per cent of the running being with wide open throttle, and at an average piston speed of 2000 ft. per minute.

Supercharging Engine

The supercharging engine used in these experiments has also been fully described in a paper read before the Institution of Automobile Engineers, and published just recently in these columns. A brief description of its operation will therefore suffice.

For the purpose of these tests it was employed almost solely for investigating the tendency of fuels to detonate, and in order to make the detonation as severe as possible, a somewhat higher compression ratio was used than formerly, and at the same time the exhaust valve was arranged to open earlier in order to reduce to the minimum the proportion of cooled exhaust gas in the scavenge and supercharge air. From the point of view of investigating detonation it was found to be more sensitive than the variable compression engine, also very accurate readings could be taken in a remarkably short space of time—an important consideration in all experimental work, more especially when dealing with samples of which the quantity was very limited, as was the case with many of the "pure" samples.

This engine has a cylinder of 4⅜-in. bore and 5½-in. stroke, and was intended to run normally at a speed of 1500 r.p.m., at which speed all tests for detonation were carried out. The valves are arranged with the inlet directly over the exhaust, both valves being in a side pocket. It is fitted with a crosshead type piston, and for the purposes of these experiments with a fixed compression ratio of 5.18:1.

Supercharging is effected in the following manner:—Advantage is taken of the differential area of the piston and crosshead to pump air, which is drawn into a chamber below the piston through a series of very light bronze flap valves; the air thus entrapped is compressed by the piston to a pressure of about 10 lb. per sq. in., and then delivered through a water-cooled intercooler to the cylinder. The lower end of the cylinder barrel is perforated with a number of small ports just uncovered by the piston at the bottom of its stroke. The cycle of operations beginning with the induction stroke, is as follows:—

As the piston descends a mixture of fuel and air enters the cylinder through the inlet valve in the usual manner, and at the same time the air in the chamber below the piston is compressed. At about 95 per cent of the downward stroke the ports referred to previously are uncovered by the piston and the air in the crosshead chamber enters the cylinder, after passing on its way through the water-cooled intercooler which removes from it a large proportion of the heat of compression and also of the heat picked up from contact with the underside of the piston. About the same time the main inlet valve to the cylinder is closed and the pressure in the cylinder rises, due to the addition of the supercharge air, from slightly below atmospheric pressure to 5 lb. per sq. in. above. The additional air entering in this manner does not mix freely with the fuel and air in the cylinder, but forms more or less a layer over the crown of the piston. On the following upward stroke the contents of the cylinder are compressed, and at the same time a fresh supply of air is drawn into the crosshead chamber below the piston. During compression very little mixture between the live charge and the supercharge takes place. On ignition the inflammation of the first portion of the charge causes a local and rapid rise of pressure, and so sets up a fresh disturbance which causes complete or nearly complete admixture of the cylinder contents, but not until the first portion is fully ignited. During the expansion stroke the second charge of air drawn into the crosshead chamber is compressed. Toward the end of this stroke the exhaust valve opens and the bulk of the products of combustion are discharged. Shortly after the opening of the exhaust valve the ports in the cylinder wall are again uncovered by the piston, a second charge of cool compressed air then enters the cylinder, driving before it some of the remaining products of combustion. During the following upward stroke of the piston the contents of the cylinder are discharged through the exhaust valve, leaving only the compression space full of a mixture of exhaust products and air. At the same time a fresh charge of air is drawn into the crosshead chamber in readiness for the supercharge.

From the above brief description it will be seen that the cylinder is alternately scavenged and supercharged by means of the air compressed below the working piston. The additional air provided in this manner per cycle is probably about 40 per cent. The supercharge air can be measured with a fair degree of accuracy and amounts to from 34 to 35 per cent of the total cylinder volume; the amount added due to the scavenging cannot so readily be assessed, but is probably in the neighborhood of 5 per cent.

For controlling or cutting off the supercharge a movable shutter is provided, surrounding the ports in the cylinder wall in such a manner that they can be partially or completely closed. In the latter event the engine runs in every respect as a normal four-cycle engine, and the air in the crosshead chamber is alternately compressed and expanded. The shutter is so arranged that the supercharge can be introduced or cut off instantaneously. In so far as the testing gear is concerned the arrangements are almost precisely similar to those described previously in relation to the variable compression engine, except that the car-

bureter heating is effected by means of a hand-controlled exhaust jacket and there is no magnetically operated revolution recorder. Since, however, the supercharging engine has been employed almost exclusively for investigating the problems relating to detonation these refinements have not been found necessary. In an engine running on this cycle with an excess of air always present in the cylinder the mean effective pressure varies directly as the quantity of fuel admitted up to the point at which the whole of the supercharge air is saturated; moreover, maximum efficiency is maintained over a very wide range of mean pressure. In this respect, therefore, the supercharging engine showed a very marked advantage over the variable compression unit in which the mixture strength for maximum efficiency at each compression ratio had to be searched for in every instance. By increasing the quantity of fuel admitted the mean effective pressure could be raised in direct proportion until a point was suddenly reached at which violent detonation was set up. In the case of every fuel tested which came within the range of this engine, the mean pressure at which detonation suddenly occurred was not only very sharply defined (to within less than 1 lb. per sq. in.), but it was also found to be quite extraordinarily consistent.

This engine was constructed some six years ago for a totally different purpose, but it has proved invaluable for fuel research, and in spite of its age and the very rough usage to which continued detonation experiments must subject any engine it stood up to its work remarkably well for a period of eighteen months. It has not quite so high a standard of mechanical consistency as the variable compression engine, and is rather more sensitive to variations in oil temperature, etc., but, none the less, its performance has varied by less than 1.5 per cent at any time over a period of eighteen months' hard usage.

Miscellaneous Engines

Apart from the special research engines, samples of many of the fuels were tested in other engines on the test beds. These consisted of two or three experimental engines of various types, permanently fitted up on test beds for general research work and other more or less representative engines built by various makers, undergoing investigation of one sort or another. All these engines, whether permanent or temporary, were direct coupled to swinging field electric dynamometers and fitted with means for recording both the power and economy with a very high degree of accuracy. From a general scientific standpoint the results obtained from a large number of engines of widely different types and sizes proved extraordinarily interesting, but in so far as the fuel problem was concerned they yielded little or no information which could not be obtained more readily and more accurately on the special research engines. Each engine, of course, had its own particular characteristics depending upon the details of its design—in some the distribution was good, in others bad, some had efficient combustion chambers, others the reverse, some detonated even with a very low compression, while others would stand a high compression without trace of detonation on the same fuel. Some had insufficient heating to the carbureters, others excessive. As a result of these individual characteristics, each engine behaved differently, but all of them behaved perfectly rationally, and, once their idiosyncrasies were recognized and allowed for, the results obtained with each sample of fuel could be predicted to within very close limits from the experiments on the research engines. No single case occurred where the behavior of a fuel differed as between that in one of the research engines or any other engine, when the characteristics of the latter were taken into proper consideration.

The experiments, however, on miscellaneous engines were not without value, for they indicated that the results obtained in the special research engines could be relied upon as being applicable to any other type, provided the varying conditions were taken into account, while they afforded generally a useful check. The experiments on standard engines, however, would have been of little or no value by themselves unless run in parallel with those on the special research engines. Without the latter they would have proved misleading in many instances. For example, before any accurate deductions could be drawn as to the behavior of any particular fuel, it was found absolutely essential to determine definitely and accurately the rate of heat input to the carbureter, for upon this depends not only the degree of volatilization, but also the volumetric efficiency, and, therefore, the power output, and also to a considerable extent the tendency of the fuel to detonate. In all ordinary engines the carbureter and induction system receives heat either from the water circulation or from the exhaust pipe. In neither case is it possible either to determine the amount of heat so received or even to keep the amount constant, for readings of temperature either of the gas in the induction pipe or in the carbureter proved utterly unreliable, and were of value only when the rate of heat input also was definitely known. It has been shown previously that the rate of heat input to the carbureter, as opposed to the temperature of the gases, proved to be, in fact, one of the most important of all the controlling factors in the behavior of a fuel.

The variation in the tendency to detonate as between different forms of combustion chamber was especially marked. In the case of gasoline "A," for example, this detonated in the variable compression engine at a compression ratio of 6:1. In the case of several of the other engines it detonated at ratics below 5:1, and in one extreme instance of bad combustion chamber design it actually detonated with a compression ratio of only 4.3:1. This particular engine could not run on any ordinary gasoline on full load without the use of an overrich mixture, and/or a very late ignition timing, so that its fuel consumption on most grades of gasoline was abnormally high, and it could only be run at a reasonable economy on gasolines "A" and "H."

Substitutes for Engine Bearing Metals

THE aircraft experimental station at Vienna, after extensive tests with a 100-hp. Mercedes airplane engine, stated that aluminum and zinc alloys are not suitable for engine bearings. However, alloys with 13-69.2 per cent of lead, 68.0-7.4 per cent of tin, 13-15.4 per cent of antimony and 6-8 per cent of copper proved satisfactory in endurance tests.

An interesting metallurgical process is covered by German patent No. 317-087. Cleaned wrought iron parts are covered with thin plates of gray cast iron or sprinkled with turnings of gray cast iron and then the thin layer of cast iron is melted down at white heat with the aid of a flux. The wrought iron at this high temperature absorbs some of the carbon of the cast iron surface layer and thus a steel coating is formed.

For engine crankshafts the following alloy steel is recommended by *Stahl und Eisen*:

Carbon, 0.2-0.45 per cent, or 0.2-0.4 per cent.
Manganese, 0.4-0.6 per cent, or 1.5-1.8 per cent.
Silicon, 0.2-0.3 per cent.
Chromium, 1.0-1.3 per cent.

According to carbon content and heat treatment, these steels show an elastic limit of 85,000-142,000 lb. per square inch and have a fibrous fracture.

A Laboratory for Aircraft Engine Testing

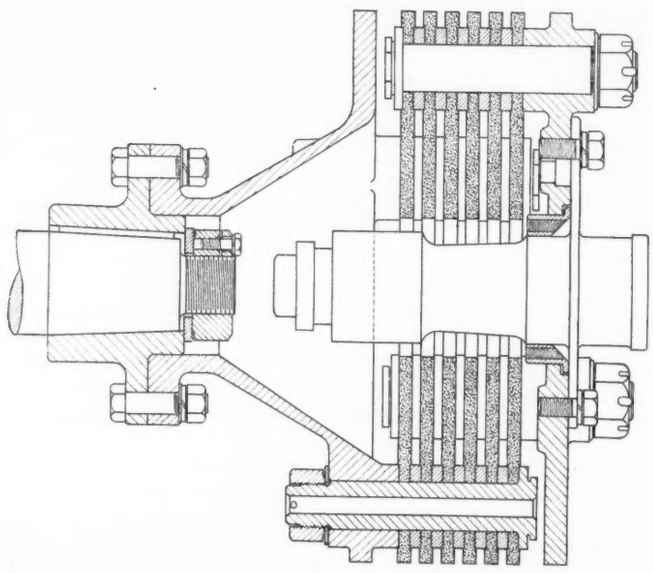
Facilities for tests of both water-cooled and air-cooled engines are fully described. Wind tunnel used for testing engine under conditions approximating those of actual flight is of particular interest.

By Herbert Chase

AMONG the best equipped laboratories in the country for aircraft engine testing is that of the Wright Aeronautical Corp., whose plant is devoted exclusively to the manufacture of high-grade aircraft engines. This plant is of thoroughly modern construction, and a considerable portion of one of the four floors of the building is given over to the testing laboratory and a shop for experimental development work. The laboratory equipment is used for routine tests of all of the engines produced by the company, as well as for special research and development work.

The primary units of the equipment are three 400-hp. Sprague electric dynamometers mounted on 14-ft. cast-iron bed plates and equipped with Toledo springless scales for torque measurement. Adjacent to each dynamometer is the panel board with circuit breakers, switches and rheostat controls. Close to this and beside the torque scale is a second control board on which are mounted the spark and throttle levers, oil pressure gage, revolution counter and a magneto grounding switch. The throttle controls are connected to the engine through steel rods and bell cranks supported on brackets between the engine and the dynamometer.

The engine is connected to the dynamometer by means of a substantial fabric disk-type coupling illustrated in one of the cuts herewith. This coupling design was originally developed at McCook Field and is still in use there. When in use it is incased by a guard of sheet metal.

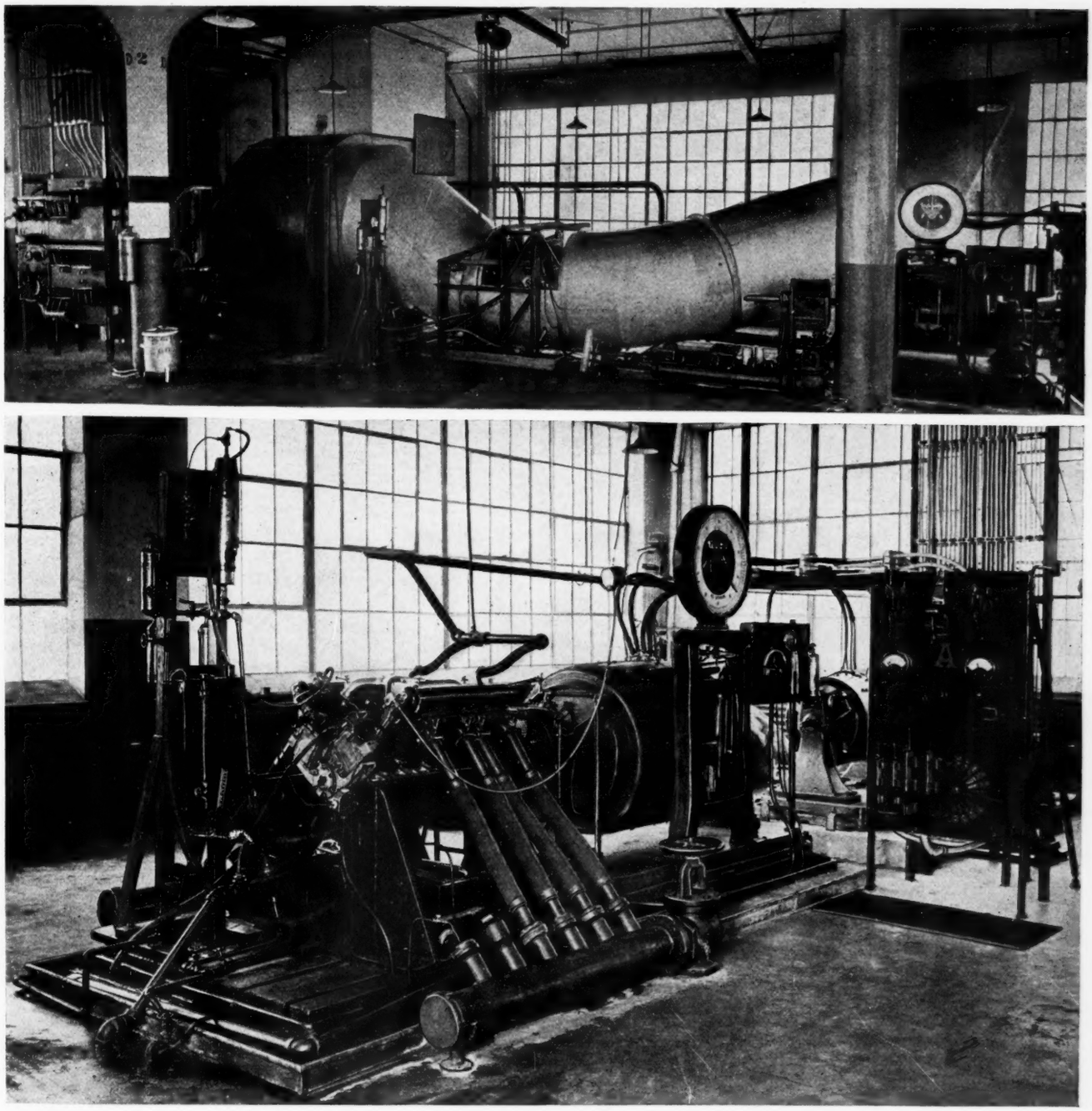


Sectional view of flexible coupling used between engine and dynamometer

The engine is supported on wooden bearers, which are, in turn, attached to conventional adjustable cast-iron supports bolted to the bed plate. Cooling water is supplied from one or both of two tanks located on an elevated stand slightly above the level of the top of the engine at one end of the laboratory. When engines are under test one of these tanks contains hot water and the other cool water at approximately air temperature. The temperature of the water entering the engine is controlled within the desired limits by valves conveniently arranged for this purpose. Water is discharged from the engine into the hot-water tank. The level in this tank is maintained by a motor-driven centrifugal pump controlled by a float switch. Water taken from the tank by this pump is delivered to spray heads located on the roof of the building, from which it returns by gravity to the cold-water tank and is recirculated through the engine.

Provisions for muffling the exhaust from the engines under test is important because of the fact that the plant is within a short distance of hospitals and dwelling houses. This is accomplished as follows: At each side of the engine base are two large exhaust headers with inlets opposite the individual exhaust pipes of the engine cylinders. Attached to each exhaust pipe is a flanged extension provided with a nipple through which water is fed to the interior of the pipe. These nipples are connected to a cold-water supply main and the water is mixed with the exhaust as the latter leaves the engine. The mixture of water, steam and exhaust gas enters the exhaust header through flexible hose connections and flows by gravity to a settling tank under the floor. In this tank the gas and water separate and the gas, with a certain amount of steam, escapes through a vent pipe carried several feet above the roof of the building. The water level in the exhaust water tank is also maintained by a motor-driven centrifugal pump controlled by a float switch. The pump delivers the water to a cooling tower on the roof, from which it is returned to the cold-water tank in the dynamometer room and used again. Addition of water to the exhaust cools it and causes it to contract. After flowing through the large pipes and the tank, which act as expansion chambers, the exhaust issues into the open air without appreciable noise, while the back pressure of the engine is only 3 in. of water.

The fuel used for all routine engine tests is a mixture containing 20 per cent benzol and 80 per cent aviation gasoline. This fuel is stored in a 20,000-gal. tank buried below ground. From this tank the fuel is pumped to a 30-gal. tank on the outside wall of the laboratory. Thence it passes by gravity through a large filter to small measuring tanks adjacent to each engine.



Two views of the Wright Aeronautical Corporation's engine testing laboratory. Above—the wind tunnel used for tests of air cooled engines. Below—one of the testing stands for water cooled engines

Lubricating oil used in the engine is circulated through a copper coil submerged in a tank of water under the engine. The temperature of the water in this tank is controlled by admission of cold water from an external source.

In starting the engine or driving it by means of the dynamometer used as a motor it is necessary to have a supply of direct current, and the same is necessary to excite the fields of the dynamometers. This current is supplied from the generator of a large motor-generator set, the motor of which is driven by alternating current furnished by the local public service company. Should this external supply of current be shut off, as sometimes happens during a thunderstorm, load would instantly be removed from the dynamometer and the engine would race and probably destroy itself and the dynamometer. To prevent this a solenoid actuated by the field current is so arranged as to short circuit the engine magnetos and thus stop the engine the instant the field circuit is broken. Provision is also made whereby the magnetos are also grounded, if for any reason the circuit breakers blow.

The electrical energy developed by the dynamometers is dissipated in resistance grids placed in a well-ventilated pent house on the roof above the laboratory.

A fourth dynamometer of 75-hp. capacity is used for tests of single-cylinder engines which it is the practice of the company to build and test before constructing engines of the multiple-cylinder type. This dynamometer is provided with auxiliary equipment similar to that used in connection with the larger machines.

One of the unusual features of the laboratory equipment is a wind tunnel designed primarily for tests of radial-cylinder, air-cooled engines, but applicable to

tests of any air-cooled engine. The tunnel is shown in one of the accompanying cuts. Air enters the tunnel through an opening in the wall of the laboratory and passes through a hopper-shaped duct into an elbow. Thence it enters the throat of the tunnel where the engine is placed and, after cooling, the engine is drawn into a large sirocco-type blower, from which it is exhausted through an opening in the roof of the laboratory. The blower is driven by chain from a 150-hp. motor, and is said to be capable of creating an air velocity of about 100 miles per hour past the engine, thus closely approximating flying conditions. The exhaust from the engine is carried out in the air stream.

The engine is completely inclosed during a test, but its performance can be observed through windows provided for the purpose. Electric lights are arranged in the tunnel so as to illuminate the parts of the engine which need to be watched. In the accompanying photograph a radial-cylinder engine is shown in place, a part of the casing of the tunnel having been removed. The engine is supported on a heavy angle iron frame designed for the purpose. Power output is measured by one of the same 400-hp. dynamometers used for tests of the Wright V-type, water-cooled product. The engine is connected to the dynamometer by a shaft several feet long and a fabric disk coupling. The shaft is supported in two bearings and passes through the wall of the elbow, which forms part of the tunnel, so that the dynamometer and all measuring apparatus are outside the tunnel, and are consequently not affected by the air stream.

A Departure in Truck Muffler Design

MUFFLERS are necessary in automotive apparatus to reduce the noise of the engine exhaust and contribute to the comfort of both the passenger and the innocent bystander. Nevertheless, their use involves initial cost, weight to be carried about, and back pressure in the cylinders. They frequently clog up with carbon deposit and constitute an entirely unsuspected source of engine loss and heating, due to greatly increased back pressure. The "blowing up" of mufflers by muffler explosions is quite common and the muffler constitutes one of the many sources of rattle in the vehicle.

The relative importance of these various factors is not the same for all automotive uses, but no one of them is negligible for any one use. It must be conceded that repairs or replacement after blowing up of the muffler, or the necessity of cleaning out the carbon, or faulty performance due to unsuspected clogging of the muffler, constitute reasonable sources of future sales resistance in any vehicle, and should be avoided if possible.

The following table is possibly representative of the general opinion of automotive engineers regarding the relative importance of the various factors in each field:

Passenger Cars

High Priced—Strength, noise, back pressure, cost, ease of cleaning, weight.

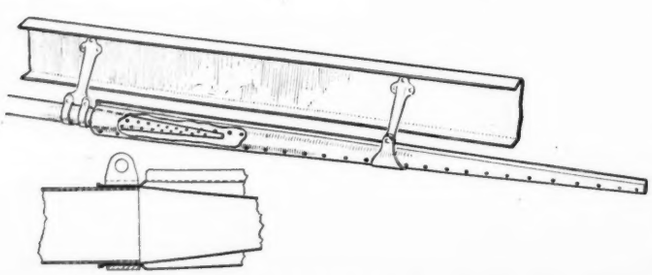
Low Priced—Cost, noise, back pressure, strength, weight, ease of cleaning.

Trucks

Heavy—Back pressure, strength, ease of cleaning, noise, cost, weight.

Light—Cost, noise, strength, back pressure, weight, ease of cleaning.

Aeronautic—Strength, back pressure, weight, wind resistance, noise, cost.



Kemble muffler showing detail of combination support and clamp for fastening muffler to end of exhaust pipe

Even after the back pressure has been so reduced as to have no serious effect upon engine power, there is still opportunity to reduce heating of the jacket water and perhaps increase the life of the exhaust valves by still lower back pressure.

In general, quietness and low back pressure are opposing factors, but each must measure up to accepted practice for any given use. Adding strength tends to increase cost and weight. Arrangements for ease of disassembling and cleaning tend to increase cost. Each muffler is an expression of the individual manufacturer's idea of the best that he can produce in the way of compromise among these various factors for any given use.

A radical departure in muffler design is about to be marketed, which is claimed to offer a better compromise for certain uses than seems possible with the conventional type, in that it is said to give a lower back pressure, to weigh less, to be entirely free from clogging troubles and practically indestructible under service conditions.

This muffler, known in aviation service as the Curtiss type, has recently been adapted to truck use and is being manufactured by the Powell Pressed Steel Company, under license from the Curtiss Engineering Corporation, and will be marketed as the "Kemble" Muffler.

In its simplest form, as applied to aeronautic work, the Kemble muffler consists of a conical shell with a narrow longitudinal slot which permits the exhaust gas to escape to the atmosphere as rapidly as the narrowing cross section of the cone tends to check the velocity and raise the pressure.

As adapted to truck use, a series of circular holes replaces the longitudinal slot, and a short inner cone is added. The muffling effect is obtained by dividing the total outlet opening into a multitude of much smaller openings, which give correspondingly smaller noises, occurring successively, and so by "stringing out" the exhaust, soften it in much the same fashion as by a continuous longitudinal slot.

The low back pressure and immunity from blowing are due to the fact that the total area of the outlet openings in the cone is approximately equal to cross section of the exhaust pipe.

The inner cone used in truck mufflers checks the velocity of the gas in the outer cone slightly by diverting the direction of flow of the gas, thus increasing the time interval over which the exhaust is strung out in a muffler of given length. This increases the muffling effect without perceptibly increasing the back pressure.

A Calorimeter for Determining the Heat of Ignition Sparks

A description of a new form of apparatus developed to determine the heat characteristics of sparks from different types of ignition apparatus is given together with the results of tests made with this equipment.

By H. A. Thornburg and E. B. Weaver*

OWING to the great possibilities of improving the ignition of gases in the cylinders of gasoline engines by studying the properties of secondary electrical discharges and their effect upon combustible gases, the results of research work along this line should be valuable to both the carburetion and ignition engineer.

The exact cause of ignition and flame propagation in a combustible gas by an electrical discharge has not been indisputably determined. A combustible gas can be ignited by heat, percussion or ionization. As an electrical discharge may produce any of the above conditions it is evident that a simple, accurate and brief method of determining any one of the characteristics of the discharge is a large step toward a method of analyzing ignition phenomena.

The Bureau of Standards has done some work toward determining the heat of ignition sparks by means of a calorimeter described in Report No. 56 of The National Advisory Committee for Aeronautics which shows one of their methods as well as some of the results obtained.

The function of an ignition system is to produce a spark with the required characteristics to cause certain and rapid combustion in the engine cylinder at the required time.

The tests run in connection with this investigation were not to prove the superiority of any one ignition system but merely to test the applicability of the spark calorimeter and to determine the general heat characteristics of the sparks from the different types of ignition systems.

The calorimeter used consists of two glass air bulbs encircling a chamber for receiving the heating element or spark gap. Between these bulbs and connected to each is a manometer with release cocks used to equalize the pressure after filling. The spark calorimeter is shown diagrammatically in Fig. 1, while a photographic view of it is shown in Fig. 2. Fig. 3 shows the driving apparatus and electric tachometer.

*—Condensed from a thesis submitted in the School of Electrical Engineering, Purdue University.

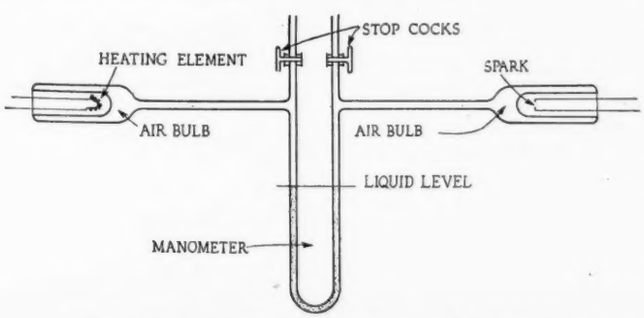
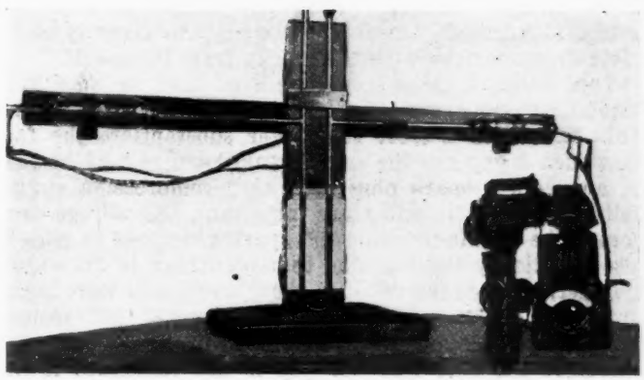


Fig. 1—Diagrammatic view of the spark calorimeter.



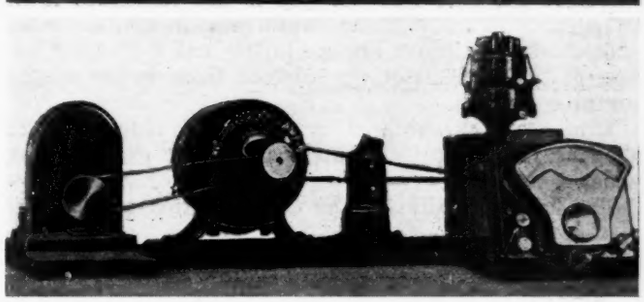


Fig. 2—(Above) view of the calorimeter. Fig. 3—(Below) view of driving apparatus and tachometer.

The heating element and spark gap were placed in their respective chambers, the distributor speed was adjusted to a desired value, and the watt input to the heating element adjusted so that a balance was obtained in the manometer. The speed was then changed to the next value, a new balance obtained in the manometer and the watt input to the heating element again recorded. This procedure was followed for the required number of points, the heating element and spark gap then being interchanged, after which the same tests were repeated.

The energy in one bulb is equal to that in the other when a balance is obtained in the manometer; therefore, the easily measured energy input to the one bulb equals the energy input of the sparks in the other bulb, and the energy of one spark is the input per second divided by the number of sparks per second.

The difference in radiation of heat due to inequality of exposed areas of the air bulbs as well as the possible error due to unequal volumes of air being inclosed in the bulbs are corrected for by interchanging the heating element and spark gap and using the mean of the read-

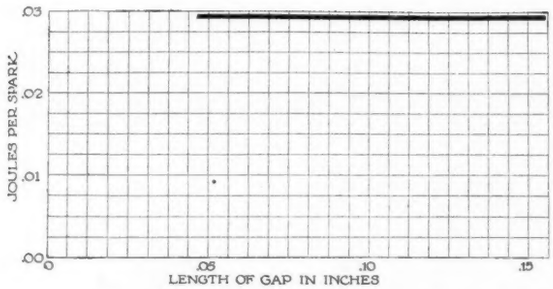


Fig. 4—Curve showing that heat of the spark is not a function of the length of the spark gap

ings. The loss due to conduction through the leads is practically compensated for, as there are the same number of leads entering each bulb.

The passage of the spark through the air caused chemical reactions to take place, such as the formation of oxides of nitrogen, but the heat energy involved is negligible in comparison with the energy from the spark.

The standard spark gap length of 0.10 in. was used throughout the series of tests, because Bureau of Standards tests with a crest volt meter substantiate the fact that such a gap has the same break down voltage as that of an average spark plug in a high compression engine cylinder. What is still more important, the voltage drop across the terminals while the spark continues to pass is also practically the same as that occurring in an engine cylinder. Since the voltages above mentioned were measured with the gap in continuous operation, they include the effect of an accumulated ionization in the chamber, and therefore the fact that the gap is not ventilated is not an objection, but is essential to the measurements, for only under these conditions are the initial and sustaining voltages of the calorimeter the same as those in the average engine cylinder.

The errors encountered by using this apparatus and allowing from 5 to 10 minutes per reading should be well under 5 per cent.

The first test was for the determination of the effect of the spark gap length upon the heat per spark with the other factors held constant. This test brought out the point that the heat per spark is not a function of the spark gap length within the range used as is shown graphically in Fig. 4.

A standard heat test was run, with the spark gap length held constant and the revolutions per minute varied between reasonable engine speeds, on one magneto and three battery ignition systems. The battery ignition heat per spark-speed characteristics were as shown in Figs. 5 to 7 inclusive. The curves all follow the same general law which is the same as that of the input curve, Fig. 6. The curve of Fig. 7 follows this general law to a certain speed and then falls off very rapidly, indicating that the theoretical number of sparks is not entering the spark chamber or, in other words, the ignition apparatus is missing. This introduces a new use for the spark calorimeter, as the slope of the curve indicates misfiring long before it can be detected by other means.

The magneto delivered a greater amount of energy to the spark gap than any of the battery outfits, and the curve of Fig. 8 shows that it had different characteristics. The magneto was operated with the timer fully advanced.

A standard Exide three-cell lead plate storage battery receiving a charge of nine amperes during test was used to supply power to the battery ignition sets during runs.

The authors regard the calorimeter as the best means of measuring the energy output of a high tension ignition system as the instruments ordinarily used in measuring electrical power are not suitable for such high voltages and feeble currents. The instruments for measuring the high voltages are subject to large errors and are cumbersome to handle.

A calorimeter as designed and used in the above work, operated upon a balance principle, with a zero method of obtaining readings, is far superior to the ordinary type as to its adaptability for a spark calorimeter, in that it is very sensitive and the readings may be had at short intervals and continuously from one point to the next with unusual precision.

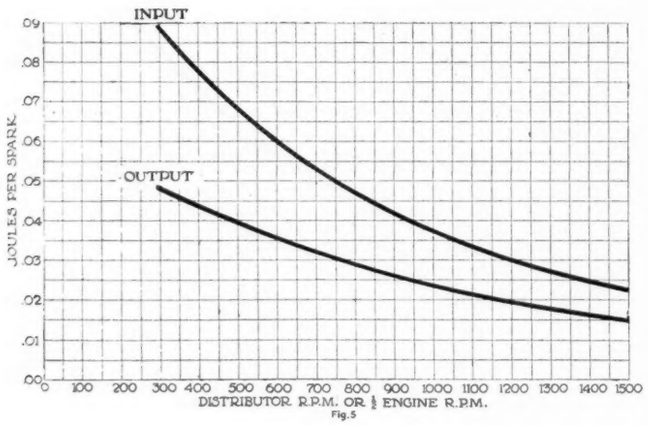


Fig. 5

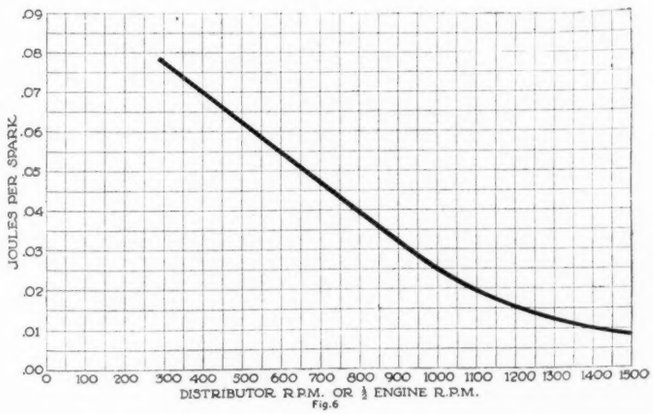


Fig. 6

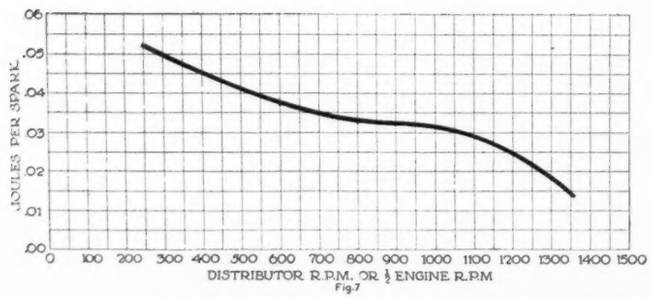


Fig. 7

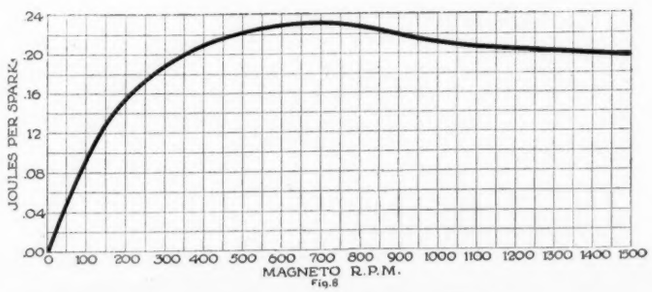


Fig. 8

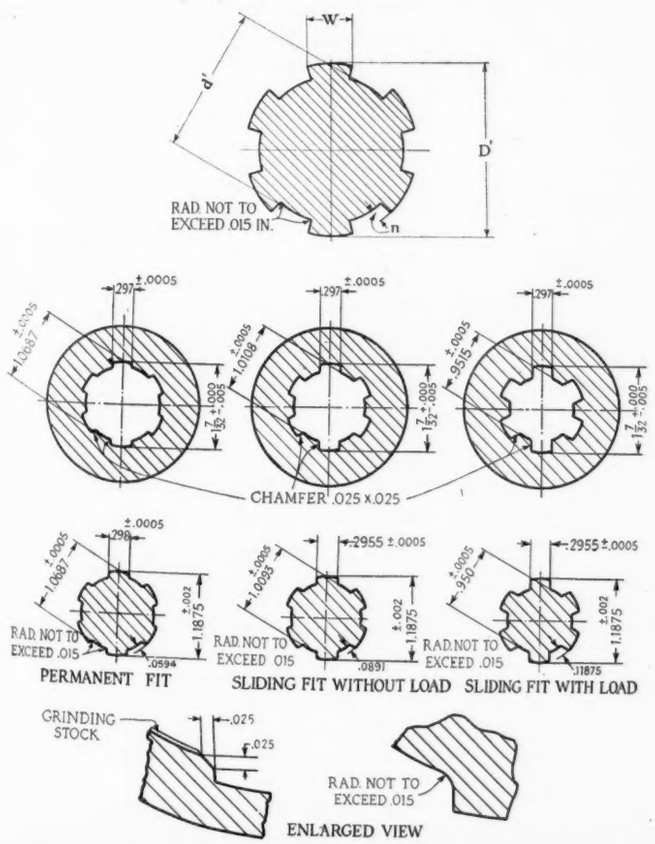
Curves showing heat per spark in three battery systems (Figs. 5, 6 and 7) and one magneto system, Fig. 8

Tolerances Allowed in Grinding Splined Shafts

An article discussing the practice employed by a manufacturer in grinding shafts to mate with splined fittings finished in accordance with S.A.E. standard practice. A table of tolerances is included.

CONSIDERABLE variation exists at the present time in regard to manufacturing practice on spline shafts. The Society of Automotive Engineers has standardized spline fittings, but the shafts themselves have not as yet been standardized, with the result that there is no uniformity in conditions as regards fit of these shafts. The tabulation herewith presented has been made up from blueprints provided by the Gear Grinding Machine Co., and is the practice recommended by that concern.

It will be noted that the bearing is solely on the ground surface of the inner diameter of the fitting, while considerable clearance is left at the bottom of the broached hole for the spline. It is an easy operation to grind the bore of the spline fitting. If it is necessary, however, to hold the depth of the broached holes to a small tolerance such as .001 in., the life of the broach is necessarily considerably shortened because it is impossible to regrind the broached cutter and still hold this limit. With the large clearances between the spline and the bottom of the broached hole, the broach can be reground several times as .009 in. is allowed for wear. Inasmuch as the cost of these broaches ranges from $75 to $300, this represents a material saving. Another advantage of the large clear-



1—Drawing showing practice adopted by Gear Grinding Machine Co., for Standard 1-3/16 in. six spline shaft.

PERMANENT FIT

Nom. Diam.	D' Max.	D' Min.	d' Max.	d' Min.	W' Max.	W' Min.	n
1	1.002	.998	.9005	.8995	.2525	.2505	.050
1 1/16	1.0645	1.0605	.9567	.9557	.2675	.2665	.05315
1 1/8	1.127	1.123	1.0130	1.0121	.2825	.2815	.05625
1 3/16	1.1895	1.1855	1.0692	1.0682	.2985	.2975	.0594
1 1/4	1.252	1.248	1.1255	1.1245	.3190	.3180	.0625
1 5/16	1.3145	1.3105	1.1817	1.1807	.3295	.3285	.06565
1 3/8	1.377	1.373	1.2380	1.2370	.3455	.3445	.06875
1 7/16	1.4395	1.4355	1.2942	1.2932	.3605	.3595	.0719
1 1/2	1.502	1.498	1.3505	1.3495	.3765	.3755	.075
1 9/16	1.5645	1.5605	1.4067	1.4057	.3925	.3915	.07815
1 5/8	1.627	1.623	1.4630	1.4620	.4075	.4065	.08125
1 11/16	1.6895	1.6855	1.5192	1.5182	.4235	.4225	.0844
1 3/4	1.752	1.748	1.5755	1.5745	.4390	.4380	.0875
1 13/16	1.8145	1.8105	1.6317	1.6307	.4545	.4535	.09065
1 7/8	1.877	1.873	1.6880	1.6870	.4705	.4695	.09375
1 15/16	1.9395	1.9355	1.7442	1.7432	.4855	.4845	.0969
2	2.002	1.998	1.8005	1.7995	.5015	.5005	.100

Maximum press fit on keys = + .002
Minimum press fit on keys = .000
Maximum press fit on body = + .001
Minimum press fit on body = — .001
Maximum clearance in diameter over keys = About .033
Minimum clearance in diameter over keys = About .025

TO SLIDE WHEN NOT UNDER LOAD

Nom. Diam.	D' Max.	D' Min.	d' Max.	d' Min.	W' Max.	W' Min.	n
1	1.002	.998	.8505	.8495	.2490	.2480	.075
1 1/16	1.0645	1.0605	.9036	.9026	.2650	.2640	.0797
1 1/8	1.127	1.123	.9565	.9555	.2800	.2790	.0845
1 3/16	1.1895	1.1855	1.0098	1.0088	.2960	.2950	.0891
1 1/4	1.252	1.248	1.0630	1.0620	.3115	.3105	.09375
1 5/16	1.3145	1.3105	1.1160	1.1150	.3270	.3260	.9845
1 3/8	1.377	1.373	1.1695	1.1685	.3430	.3420	.103
1 7/16	1.4395	1.4355	1.2223	1.2213	.3580	.3570	.10785
1 1/2	1.502	1.498	1.2755	1.2745	.3740	.3730	.1125
1 9/16	1.5645	1.5605	1.3286	1.3276	.3900	.3890	.1172
1 5/8	1.627	1.623	1.3815	1.3805	.4050	.4040	.122
1 11/16	1.6895	1.6855	1.4348	1.4338	.4210	.4200	.1266
1 3/4	1.752	1.748	1.4880	1.4870	.4365	.4355	.13175
1 13/16	1.8145	1.8105	1.5411	1.5401	.4520	.4510	.13595
1 7/8	1.877	1.873	1.5945	1.5935	.4680	.4670	.1405
1 15/16	1.9395	1.9355	1 6473	1.6463	.4830	.4820	.14535
2	2.002	1.998	1.7005	1.6995	.4990	.4980	.150

Maximum freedom on keys = .0025
Minimum freedom on keys = .0005
Maximum freedom on body = .0025
Minimum freedom on body = .0005
Maximum clearance in diameter over keys = About .033
Minimum clearance in diameter over keys = About .025

TO SLIDE WHEN UNDER LOAD

Nom. Diam.	D' Max.	D' Min.	d' Max.	d' Min.	W' Max.	W' Min.	n
1	1.002	.998	.8005	.7995	.2490	.2480	.100
1 1/16	1.0645	1.0605	.8505	.8495	.2650	.2640	.10625
1 1/8	1.127	1.123	.9005	.8995	.2800	.2790	.1125
1 3/16	1.1895	1.1855	.9505	.9495	.2960	.2950	.11875
1 1/4	1.252	1.248	1.0005	.9995	.3115	.3105	.125
1 5/16	1.3145	1 3105	1.0505	1.0495	.3270	.3260	.13125
1 3/8	1.377	1.373	1.1005	1.0995	.3430	.3420	.1375
1 7/16	1.4395	1.4355	1.1505	1.1495	.3580	.3570	.14375
1 1/2	1.502	1.498	1.2005	1.1995	.3740	.3730	.150
1 9/16	1.5645	1.5605	1.2505	1.2495	.3900	.3890	.15625
1 5/8	1.627	1.623	1.3005	1.2995	.4050	.4040	.1625
1 11/16	1.6895	1.6855	1.3505	1.3495	.4210	.4200	.16875
1 3/4	1.752	1.748	1.4005	1.3995	.4365	.4355	.175
1 13/16	1.8145	1.8105	1.4555	1.4495	.4520	.4510	.18125
1 7/8	1.877	1.873	1.5005	1.4995	.4680	.4670	.1875
1 15/16	1.9395	1.9355	1.5505	1.5495	.4830	.4820	.19375
2	2.002	1.998	1.6005	1.5995	.4990	.4980	.200

Maximum freedom on keys = .0025
Minimum freedom on keys = .0005
Maximum freedom on body = .0025
Minimum freedom on body = .0025
Maximum clearance in diameter over keys = About .033
Minimum clearance in diameter over keys = About .025

ance above the spline is the adequate provision for an oil pocket which is of assistance in lubrication. To hold the bottom of the broached hole to the close limits which prevail in some instances is a good example of unnecessary accuracy.

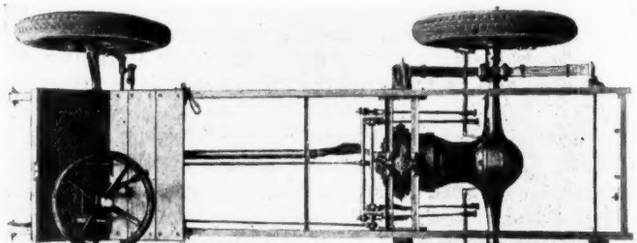
While the accompanying table is not a standard and has not been brought out as such, it is practice recommended by a concern which specializes in the grinding of splined shafts and as such deserves serious attention. It has been suggested that the societies concerned consider the adoption of some such set of tolerances for standardized practice in connection with the six spline fitting.

The tabulation herewith in common with the spline fitting standards, has been made up for three different conditions; that is, permanent fit, sliding fit without load and sliding fit with load. The permanent fit is for arbor press assembly, to be used for such parts as clutch spiders and other parts, which have no relative motion between the spline fitting and the shaft. The sliding fit without load is used on such parts as the sliding gear shaft on transmission gearsets, etc. The sliding fit with load is a free fit used in propeller shaft construction, etc.

Lansden Electric Speed Truck

THE success of the gasoline-propelled type of speed wagon and speed truck has evidently stirred the manufacturers of electric commercial vehicles to emulation, and a speed truck of 1500 lb. capacity is being announced by the Lansden Co., Inc. With an electric vehicle, of course, no such speeds as obtained with modern pneumatic tired gasoline trucks are possible, and the speed of the truck here described is limited to 15 m.p.h. loaded and 16½ m.p.h. empty. This, however, is quite an improvement over the speeds obtained with electric commercial vehicles running on solid rubber tires and is about up to the limit of the speeds permitted in cities.

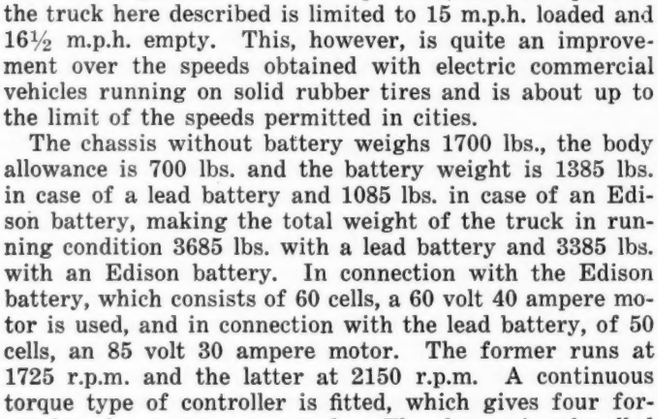
The chassis without battery weighs 1700 lbs., the body allowance is 700 lbs. and the battery weight is 1385 lbs. in case of a lead battery and 1085 lbs. in case of an Edison battery, making the total weight of the truck in running condition 3685 lbs. with a lead battery and 3385 lbs. with an Edison battery. In connection with the Edison battery, which consists of 60 cells, a 60 volt 40 ampere motor is used, and in connection with the lead battery, of 50 cells, an 85 volt 30 ampere motor. The former runs at 1725 r.p.m. and the latter at 2150 r.p.m. A continuous torque type of controller is fitted, which gives four forward and two reverse speeds. The frame is of rolled channel steel 3 x 1½ x 3/16 in. The truck is made in two lengths of wheelbase, 90 and 96 in., while the track is the standard 56 in. Thirty-two by 4½ in. pneumatic cord tires are used all around. The standard equipment consists of a tail lamp, two dash lamps, horn, hub odometer, Sangamo ampere-hour meter, a kit of tools and 12 ft. of cable with charging plug.



Chassis of Lansden 1500 lb. electric speed truck

The Sharon "Brute" Trailer

THE industrial trailer here illustrated, a product of the Sharon Pressed Steel Co., was designed for heavy-duty service with tractors, in warehouses, terminals and transfer stations. The frame is made up of 4⅜ in. channel sections pressed from ⅛ in. hot rolled open hearth steel, riveted into one piece, channel section corner pieces pressed to a 6 in. radius, with a hole for a stake pocket. The trailer can be made in any length up to 72 in. and in any width up to 50 in.



Sharon "Brute" trailer. Bottom view showing construction features.

Two additional members running lengthwise beneath the floor are 3 in. pressed steel channel, riveted to the end rails and braced laterally to the frame with front and rear pressed steel "V" braces which take the pull of the 5/8 in. steel forged coupler. Either one or two couplers can be supplied.

Rear wheel and front caster supports are 3 in. pressed steel channels riveted to the side rails and longitudinal members of the frame. Rear wheel brackets are pressed from ¼ in. steel with two stiffening ribs on each side. Rear wheels are of malleable iron with six double-web spokes and 3½ in. face, with flexible roller bearings on a 1 in. shaft hardened and ground.

The front casters with ball and roller bearings are bolted to a ½ in. steel plate riveted to the frame. The floor of the trailer is 1½ in. oak, recessed flush in the side and end rails. All frame members are flush on the bottom—thus affording an even support when the trailer is used in connection with a lift truck.

A Practical Analysis of British India as a Market for American Motor Vehicles

Part I

In this and a following article is presented a detailed survey of British India as a market for cars and trucks. The author has a wide experience with this field and shows clearly the great potentialities, if proper methods are used. An important contribution to foreign selling data.

By Charles Sumner Turner

SIX months ago our export trade in passenger vehicles with British India abruptly stopped and has since been at a standstill. This condition follows a record year of exports to that market in 1920. There has been and continues some congestion of passenger car stocks in India in trade hands or held for the account of the trade. Considerable inconvenience and some distress attends this condition.

A review of the trade leading up to these conditions and an intimation of some of the causes will form the basis for a detailed and practical discussion of merchandising American cars in a market extremely rich in potential business if conditions are accurately known and proper methods are used. The prevailing depression in American automotive export trade makes this an opportune time to review the past and take therefrom such lessons as may be useful in formulating plans for future business.

THE present congestion of passenger cars in trade hands in India is the result of overordering, imprudent credit facilities and deferred shipments by manufacturers. Future credit facilities must depend upon a mutual recognition of obligation by buyer and seller.

Less than a dozen American passenger-car manufacturers can rightly claim an intimate knowledge of the British Indian market and its dealer trade. An excellent trade can be developed in this field if sound methods of merchandising are used.

Statistical information on American automotive exports for the year 1920 shows marked changes in the relative positions of importance of foreign markets. Certain distant markets are brought into sharp focus, among which British India, by purchasing among other of our automotive products over 12,000 passenger vehicles of a value approximating $14,000,000, attained second position among our foreign markets for products in this class.

Interpreting Export Figures

The foregoing figures inadequately evidence the actual benefits that accrued to the American passenger car industry from the British Indian trade, for the reason the several thousand Canadian-made vehicles appearing, directly and indirectly, in the British Indian Government import records, were, as regards the manufacture of their component parts, largely a product of American industry.

The record of our relative exports thus far this year and the prospect for the balance of the year indicate an export trade in passenger cars with British India that shall show a falling off by about 95 per cent of the 1920 year business. Consequently, it is necessary to accord serious thought to ways and means for the American automotive industry to continue to secure the largest amount and share of the British Indian automotive trade.

The distance of the market from the United States, its peculiar trade conditions, and its past importance as a purchaser of American finished products have caused British India to be known and understood by the general automotive trade very disproportionately to the importance now attained. We have accorded our greatest attention to markets near to us, while several distant markets within themselves present greater sales opportunities than many of the former combined. British India, of such great size, distances and potentialities of material development, is only experiencing the genesis of motor transport.

In the last British Indian pre-war trade year, ending March 31, 1914, the total merchandise imports into India from all countries were approximately $500,000,000, of which the United Kingdom supplied 65 per cent and the United States supplied 3 per cent, or about $15,000,000. Of our exports, mineral oils, iron and steel products comprised considerably more than one-half, and in the balance were included "Motor cars and cycles" of an approximate value $750,000.

Importance of Indian Market

In this year 868 American cars, mainly Ford, were imported into India. In the last trade year of British India ending March 31, 1921, the total merchandise imports from all countries reached the record valuation of approximately $1,125,000,000, of which the United States supplied $120,000,000, included in which were 10,120 motor cars, valued at $15,025,000, the valuation of the import trade in American passenger cars for this year approximating the value of all imports from the United States in the last pre-war trade year.

During the 1919-20 year the trading of other automotive exporting countries was effectively renewed in India as is strongly evidenced in the following tabulation of Indian Government import statistics:

Imports of Motor Cars into India
For fiscal years ending March 31.

	1920		*1921*	
From	*Quantity*	*Value*	*Quantity*	*Value*
United Kingdom	448	$1,209,610.00	2,541	$7,113,304.00
France	3	5,705.00	192	483,122.00
Italy	17	34,808.00	218	552,344.00
Other countries	84	139,274.00	423	862,829.00
	552	$1,389,497.00	3,374	$9,011,599.00
Canada	20	16,731.00	1,938	2,041,860.00
United States.	9,353	10,149,010.00	10,120	15,024,529.00
	9,925	$11,555,138.00	15,432	$26,077,988.00

The above United States currency valuations have been arrived at by converting official Indian rupee valuations at adopted averages of 44 cents for the 1920 year and 33⅓ cents for the 1921 year, these being fair averages for the respective periods in considering the exchange movement.

It should be pointed out that the import figures relative to imports from Canada and the United States for the year 1920 are misleading, as will be explained further along.

It is interesting to review some of the incidents of American passenger car trade with British India over the seven year period including the years 1913-14 to 1920-21.

The accompanying graphic chart shows, by heavy solid line, the United States Government statistical record of passenger car exports, by years, from the United States to British India (and Ceylon). The light solid line at the bottom of the chart shows, for the years 1919 to 1921, the same record of monthly exports.

The broken lines show the British Indian Government statistical record of passenger car imports into British India and Burma (not including Ceylon) from the United Kingdom, United States, Canada and other countries. It is desired to point out that the seeming discrepancy in the two records is a matter of method and not of fact, and is due to the statistical method of the British Indian Government, according to which imports are recorded as from the point (by land or sea) merchandise is shipped to India, and not according to the country of origin. Therefore, the apparent excess amount and advanced movement of American passenger car imports into India to what is recorded in the United States Government figures, is explained by cars of Canadian origin being shipped through American seaports to India; further, the charted record of British Indian imports of passenger cars from Canada is not a true index of the number of Canadian cars imported, but can be assumed to show only such cars as were accommodated by steamship tonnage from a Canadian port to India direct. The movement of the Indian rupee exchange value, over the years 1919 to the middle of 1921, is also shown in graphic form.

The Course of Trade

The chart shows that, in the last pre-war trade year, British India was importing from the United Kingdom twice as many (1670) passenger cars as from the United States (868), the import valuation of the former being five times that of the latter. The predominance of Ford cars makes it reasonable to assume that, as regards other makes of American motor vehicles, the position of such cars in the market was inferior to the position of cars "imported from other countries," namely, Continental Europe (268).

The drop in car imports to the middle of 1915 reflects the realignments and adjustments of trade, which were attended by general depression incident to the first year of the war. The adverse effect on car imports from all sources was generally the same.

The car import record throughout the balance of 1915 and into 1916 shows a further falling off of United Kingdom trade with the territory due to the diversion of manufactured products of that country to war purposes, while imports of American vehicles continued rapidly increasing, due to demands resulting from the beginnings of an unprecedented prosperity within British India which continued well into the year 1920.

India's staple and manufactured products benefited by the war demands and the general prosperity of her customers removed from the war area, and not only were extraordinary profits made in industry and trade, but new trade routes were defined in the Near East, the Mesopotamian campaign having been largely manned, provisioned, and supplied from Indian industry. Thus British India experienced an industrial rebirth which is viewed with great interest and satisfaction within and without the country. This portends an increased expansion and extension of the indigenous industries of the country and greater independence of outside sources of supply in many lines of manufactured goods.

The Embargo

In December, 1916, an embargo was placed by the Indian Government on the import of motor cars, with a view to the saving of tonnage and fuel, and thereafter, except for the few months required for vehicles en route to arrive in the market, the importation of cars from any sources whatever was stopped for two years.

At the time the embargo was announced, American passenger cars were rapidly attaining an enviable position in the Indian market. The business resulted largely from demands of the market and was attended by a minimum of solicitation by and expense to the American manufacturers and traders benefiting therefrom.

The lifting of the embargo (in December, 1918) found India enjoying extraordinary prosperity. Shortly a very extraordinary and seemingly insatiable demand for American passenger cars was manifested to the industry in this country. Making due allowance for the incident of the American automotive industry transition from a war to a peace basis and their problems with domestic demands, from an export business viewpoint, the record of passenger car exports from the United States to British India throughout the year 1919 evidences insufficient enterprise in meeting an exceptional opportunity. During this year only 2624 American passenger cars were exported to India. The seemingly discrepant record of British Indian imports is explained by Canadian made vehicles passing through American seaports for shipment to India and such appearing in the records incorrectly as imports from the United States.

The Ford Motor Co. apparently made the most of the opportunity in India by shipping large quantities of cars early. These arrived in the territory at the time of an extraordinary demand and an appreciating exchange value of the local currency. Thus material benefits accrued to the manufacturers, their dealers and the buying public. Furthermore, during this period this company made long strides in developing their merchandising policy in the territory by dictating the segregation of their affairs, by the principal dealers concerned, into distinct corporate concerns dealing exclusively with this firm's product.

Unsound Selling Methods

In the winter months of 1919-20, American factories began the movement of extraordinary quantities of passenger cars against Indian orders, in many cases considerably deferred in their execution, and the complete story

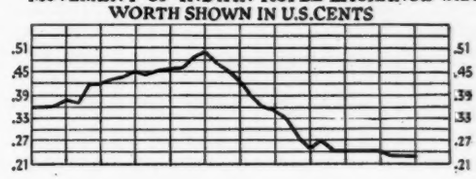
of the incidents and effect of the large shipments to India throughout the year 1920 cannot be told at this time. Some manufacturers, financiers and dealers concerned with the business are continuing to experience inconvenience, and of the latter some are in distress.

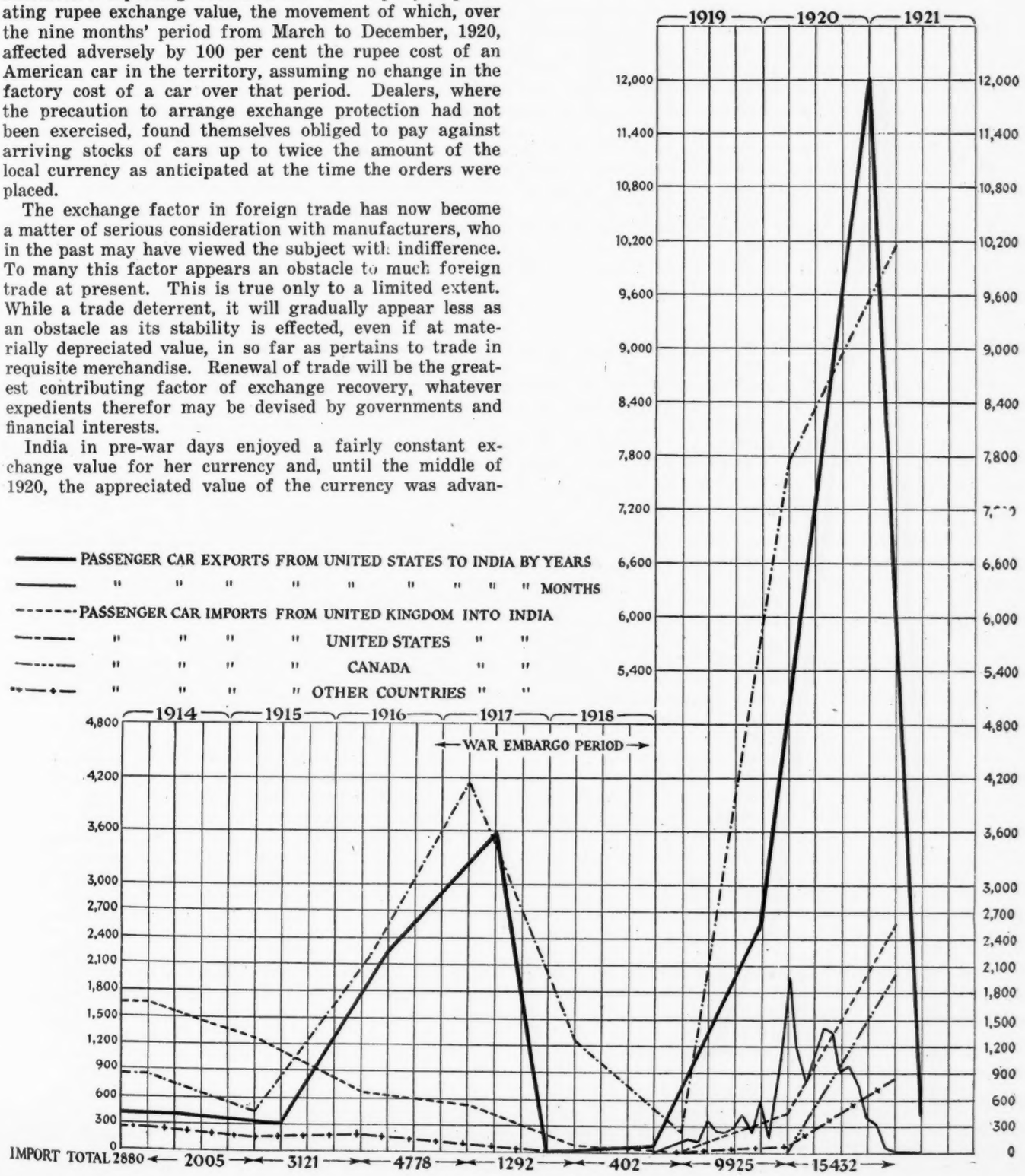
As the movement of passenger cars from the United States to India got well under way in 1920, the peak of prosperity in the latter country was passed, but an extraordinary movement of cars continued throughout the year in the face of a precipitant reaction of general trade in the market, effecting renewed trading there by other automotive exporting countries and the rapidly depreciating rupee exchange value, the movement of which, over the nine months' period from March to December, 1920, affected adversely by 100 per cent the rupee cost of an American car in the territory, assuming no change in the factory cost of a car over that period. Dealers, where the precaution to arrange exchange protection had not been exercised, found themselves obliged to pay against arriving stocks of cars up to twice the amount of the local currency as anticipated at the time the orders were placed.

The exchange factor in foreign trade has now become a matter of serious consideration with manufacturers, who in the past may have viewed the subject with indifference. To many this factor appears an obstacle to much foreign trade at present. This is true only to a limited extent. While a trade deterrent, it will gradually appear less as an obstacle as its stability is effected, even if at materially depreciated value, in so far as pertains to trade in requisite merchandise. Renewal of trade will be the greatest contributing factor of exchange recovery, whatever expedients therefor may be devised by governments and financial interests.

India in pre-war days enjoyed a fairly constant exchange value for her currency and, until the middle of 1920, the appreciated value of the currency was advan-

MOVEMENT OF INDIAN RUPEE EXCHANGE VALUE
WORTH SHOWN IN U.S.CENTS





tageous to purchases by that country from the United States. The present instability of Indian exchange perplexes those heretofore experienced with an approximately fixed or favorable value.

Meet Obligations Promptly

An element of British Indian trade stands, at this time, discredited by their refusal to promptly meet their obligations in the face of extraordinary trade and economic conditions, and endeavor to justify their attitude by contending that manufacturers shipped late and that authorities bungled exchange. The large majority of American motor cars that went to India having been purchased by, or the purchases having been financed by Anglo-Saxon banks and firms, the foregoing difficulty is reflected lightly on the car manufacturers that supplied the market. Credit facilities, however, for the future must depend upon preciseness in method and a mutual recognition of obligation by buyers and sellers.

The abnormal car exports from the United States in 1920 would, if considered as distributed over a three-year period, have been sub-normal yearly shipments, assuming British Indian imports for the year 1917 to be a fairly accurate index of the buying power of the market at that time in its development. The normal yearly purchase potentialities of the market is probably higher than the example cited.

Causes of Congestion

The present congestion of passenger cars in trade hands, or held for the account of traders, results from over-ordering, imprudent credit facilities, and deferred shipments by manufacturers. Dealers in many cases undertook on paper more than they possessed the physical and financial facilities to assimilate, except in such ordered manner as their original plans of business proposed. Consequently the radically changed economic conditions in the territory disrupted automotive trade conditions particularly.

Deferred shipments by some American car manufacturers are among the vital causes of the present car congestion and consequent stoppage of business in this line out of British India. The intelligent treatment of an export order requires that a manufacturer regard the distance of the buying market from the factory. Priority of consideration to orders destined for the most distant markets is only common sense, but it has not been common practice. British Indian seaports are, under most favorable conditions of transport, four months distant from a factory in the Detroit district. Normally, a distributor or agent when ordering and arranging financial facilities, must act approximately six months prior to his anticipated receipt of merchandise. American automotive export trade must move to normalcy of volume, value and method. Hereafter intelligent effort must replace the easily available credit facilities that have encouraged much past business, the good will of which is difficult to discern.

Less than a dozen American passenger car manufacturers can rightly claim an intimate knowledge of the British Indian market and its dealer trade. The arrangements and products of these few manufacturers are well advanced along the trade's evolution in the market. Motor trade establishments in India have much to do in the matters of developing organizations physically and financially commensurate with problems and volume of business incidental to a proper merchandising of American automotive products. The burden rests on the American manufacturer to assist intelligently in this evolution.

The important Indian pre-war firms engaged in the automotive trade resulted from trading in English and Continental cars. These firms, and they are not many, are pre-eminent to-day and control the best agencies. Meanwhile, they undoubtedly have at times the refusal of every interesting agency proposition seeking introduction to the market.

The abnormal business of the recent past has caused many firms and individuals to be attracted by the automotive trade prospects of profit, and the future success thereof manufacturers may assist according to the degree of intelligent co-operation they extend.

Many manufacturers, if they would continue to share in the British Indian automotive trade, must predicate future arrangements on a proper knowledge of that market and its trade, and a useful presentation, therefore, shall appear in a following article.

The present trade depression in India is a reaction from abnormal trade conditions over several years of great prosperity and is consonant with world wide trade depression at this time. The future of British Indian trade, however, was never more interesting than at the present time. Statistical information assigns to British India an important position among the world's markets for our automotive products. Of the markets for motor vehicles where trade is at this time affected adversely, it is expected by those conversant with the market that British India will recover among the first.

The impending visit of the Prince of Wales in November this year shall have a very beneficial effect on the motor trade in India. We have generally little comprehension here in America of the general commotion of population, ceremonies peculiar to the people and the institutions of the country, and the disbursements that shall be an incident of this imperial honor to the British Empire.

When considering future motor trade with the territory, manufacturers will do well to disregard the facility and economy that attended the consummation of the extraordinary business of recent years, and regard thoughtfully the hindrances to our trade actual or in prospect at the present time. Some manufacturers, if they would successfully meet future conditions and perpetuate that goodwill which should attend their past business, must seriously consider capital investment against prospective, if not immediate business.

Building Permanent Business

At the moment visible signs show American manufacturers to be generally inactive. Advertising of American cars in effective British Indian media is conspicuous by its absence, except Ford advertising. British manufacturers, on the other hand, are very active and are freely advertising their products. They realize there is hard work to be done to regain the trade from which they were eliminated by war conditions.

As stated hereinbefore, the foremost motor trading firms in India owe their beginnings to the agencies for British and Continental cars, and relationships continued for years prior to the war appear to be maintained to the present, as agencies generally continue in the same hands as in pre-war days. The British Indian trade came to America for cars during and after the war and many dealers there, wrongly or rightly, are not particularly happy with all the results that have accrued from the business. American car manufacturers should recognize the fact that, in the competition for trade, the British manufacturer has many psychological and some economic factors in his favor under prevailing conditions. Continental manufacturers enjoy some advantages also.

Statistically, however, India is America's foreign car market of second importance. And an analysis of the potentialities of the market confirm this rank, provided the trade is intelligently and aggressively solicited.

1922 a Light Car Year in Great Britain

American lightness is to be blended with European fuel economy in the 1922 British models according to present indications. The day of the expensive car in England appears to be waning. General specifications of the predominating type for 1922 are indicated in this article.

BRITISH makers of cars have nearly settled the details of their 1922 season's program, and it is possible at present to surmise the trend, though unsafe to deal with the question except in a general way. It may be definitely stated, however, that 1922 will be a light-car year. And by "light car" is meant a blend of American lightness and roominess with the higher economy of the European type of engine.

A reduction of the horsepower tax, which at present is £1 per horsepower by formula rating, has been promised. If this reduction is announced soon, it may be assumed safely that the standing rating for 1922 season's cars will be not less than 15 hp. If the power tax be reduced by a third, it will mean that the 15-hp. (usually 15.9) car, now taxed £15, will pay the reduced rate of £10. The 15-hp. engine will make a great difference in the light-car outlook. A car will be produced on the lines the public wants; namely, a car with plenty of power and a reasonably large cylinder bore and ample room or girth of body.

The next problem is price. An average all-round, popular-priced car, not exceeding $2,000, with $1,500 as the mean rate, is likely to develop. The day of the high-priced, expensive car is waning, if it has not entirely passed away. If the 15-hp. model at the lower taxing rating be the standard, then there is likely to be a trend to six cylinders instead of four. This means a bore not exceeding 64 mm. (2.5 in.) or 78 mm. (3 in.) for a four-cylinder engine.

One of the biggest percentage falls in British car prices is that announced by the Rover company to take effect from September 1. It applies to the 12-hp., four-cylinder model (3 x 5⅛ in.), the four-passenger car being reduced from $3,875 to $3,200. Following on the recent price reductions of Rolls-Royce and Lanchester (each to the extent of $1,250), the Rover announcement indicates that not only the high-priced among British cars will be subject to big cuts in the general downward trend to be anticipated before the Olympia Show.

To the names of well-known British firms mentioned in AUTOMOTIVE INDUSTRIES of August 18 as planning to produce a light runabout for next year to compete with the highly successful 8-hp., two-cylinder, air-cooled Rover may now be added those of Wolseley and Belsize. The Belsize will have a modified form of the Bradshaw "oil-cooled," two-cylinder engine introduced at last year's motorcycle show at Olympia. Only the aluminum heads of the cylinders and the overhead valves are exposed to an air draught, the cylinder barrels being inclosed in the crankcase and oil cooled by the lubricant therein. The oil sump contains approximately double the quantity of oil carried in a normal engine of this size (3⅜ x 4½ in.) and, like the cylinder heads, is cooled by an air draught induced by the fan on the front end of the crankshaft. The plate clutch is located at the rear end of the gear-set; its driving members run at engine speed as usual, but the driven member is provided with a brake rotating with the propeller shaft so that gear shifting is said to be greatly facilitated. With one seat wide enough for three adults abreast, the car is planned to sell at about $1,200.

As a means to price reduction it is quite possible that the Wolseley company's lead with their "10" may be followed largely. In this case the Wolseley company is listing the "10" at a reduced price with a less elaborate finish, without a starter, but at its present price, $2,400, this model—only a two-seater—is too dear for next season's trade.

General specification will probably be along the following lines:

Engine, a four (or six) en bloc combining the upper part of crankcase, with bore and stroke of 3 x 5 in.

Dynamo and ignition combined.

Vacuum-gravity fuel feed to a direct-bolted carbureter.

Gravity cooling.

Pump oiling.

Overhead inclosed valves and inside camshaft, electric starter optional, and a demountable radiator.

Transmission, fabric-faced dry-plate or cone clutch.

Direct-coupled gear box with center gate control, four speeds and reverse gear, fabric disk couplings, spiral-bevel axle.

Short cantilever springs rear, semi-elliptic front, and dual brakes on rear axle.

Gross weight of car, with roomy, four-seater body, not exceeding 22 cwt.

Manufacturing economies will be emphasized and probably after the season's experience it will be decided to continue the design unaltered and cut the price for 1923 season, which will be the year of the great British International Show. If a program on these lines be adhered to and the wheel track be standardized to 4 ft. 8 in. (56 in.), it may happen that 1923 will usher in a renewed activity of British car enterprise in the British oversea market.

Excellent advice to American car makers interested in or prospecting this market would be:

1. Send your chassis here without bodies.
2. Improve your brakes and brake adjustment.
3. Cut your engine bore down to 3 in.
4. Get the power by lengthening stroke (3 x 5 in. is a good rate for Europe).
5. Above all, scrap your demountable rims and substitute hub-bolted wheels.
6. Stick to the wood type, for there will be a reaction here toward the wheel-like wheel (mostly the hollow-metal-spoked type), and the wire wheel will not survive on cheaper cars.

A considerable drop in tire prices may be looked for. With labor costs down, tires at about half present rates, chassis weights pared by 400 to 500 lb. and material markets decontrolled from the trusts and rings, there will be a $500 saving in the average car's production cost.

Decreasing Overhead by Increasing Individual Capacity

Better production is really a by-product of better men and better organization. Mechanical equipment cannot overcome all the difficulties of human variation. Overhead charges in many large organizations exceed by half total labor and material charges. The remedy is discussed here.

By Harry Tipper

THERE is a distinct tendency for the average capacity of the individual worker to decrease as the number of workers in the organization increases. Side by side with this tendency there is a constant tendency for the system to grow more rapidly than the amount of business would warrant, so that the opportunity for development in the individual is somewhat less.

There is, of course, a great variation in the actual development of these tendencies in different organizations due to the character of the management and the individual method of organizing. But the tendency is unmistakable and is to be observed in the growth of industrial organizations almost without exception.

The decreased average capacity is due partly to the larger difficulties in selection, requiring the manufacturer to accept workers in much larger quantities than the highly skilled minority, so that the average capacity and skill is decreased within the group as the size of the group grows.

The most important element, however, in the tendency for the individual capacity to decrease is the increased rigidity of the worker's skill, as the size of the organization grows and the number of subdivisions increases.

In small organizations it is necessary that a much larger proportion of the workers possess a capacity sufficiently flexible to permit their use for a number of different items of work. This necessity encourages the adaptability and increases the flexibility of the organization, so that each worker is used much more nearly to his capacity and the balance of the organization is preserved more accurately.

Any manufacturer who will think back to the days when he employed forty or fifty men, including his executives, will realize that most of these men were doing a great many jobs that are now the sole occupations of some specialized subdivision. They were able to accommodate themselves to the varying needs of the organization much more accurately and their capacity for growth was increased because of this adaptability and its effect upon the organization itself.

The large manufacturing concern with its thousands of employees has subdivided its work to such an extent that very few of the workers are skilled in more than one subdivision and frequently not in more than one fraction of the subdivision. They are not capable of adapting themselves to the fluctuating requirements of production within the department to the same extent. They cannot be used to consolidate the work of more than one department to the same degree, so that it is difficult to maintain the organization with all the individuals working at capacity and with the personnel balanced to the requirements.

This tendency has a good deal to do with the constant increase in the proportion of expense required for supervision and overhead in the factory costs. Not many years ago after the labor and materials were determined, 50 per cent was frequently sufficient to cover the rest of the costs. In many large factories to-day after the labor and materials have been determined, it is necessary to add 150 per cent in order to cover the fixed charges and the undivided items.

The subdivision and the increasing specialization which always grows with the large increases in the number of people employed in the organization demand a centralized system that has a tendency to enlarge itself more rapidly than the problem would warrant. Perhaps "demand" is not the correct word to use in this case, because the systems employed at present have not justified their existence as necessities in large organizations to the degree in which they have been used.

The past practice has assumed that these centralized systems were necessary with the constant subdivision of the work, and they have grown with great rapidity.

For instance, a man was called recently to the head of a business office to rearrange the work and put it on a better basis. He started in to familiarize himself with the methods employed. Picking up a letter which required an answer giving the customer certain information, he asked what would be done about it. He found that six people handled that letter before it was answered. Yet the same kind of letter was answered every day and the information was available to any of the clerks.

Subdivision of work and the arrangement of the system to agree with the subdivisions, rather than with the necessities, had created such a rigidity that the cost of some of the work was multiplied four or five times.

The examination of many of the factory systems will show a considerable percentage of the same rigid development without regard to the object but with a great deal of attention to the subdivisions and specialized departments. This tendency to a rigid subdivision and system itself still further decreases the average capacity by discouraging adaptability and increasing the difficulty of maximum work and balanced operations.

One of the well-known industrial engineers, in talking of a great industry the other day, claimed that not one of the factories in that industry was balanced so that it could operate full time in all departments and secure

a co-ordinated production. This is partly accounted for by the narrow specialization in the work and the rigidity of the system with their effect upon the natural adaptability of the intellect and flexibility of the skill.

The question is one of management. If it is possible for a hundred people to work together with a fair degree of human efficiency, a reasonable degree of understanding, and a flexible arrangement of production it is possible to get five thousand working together in the same way. True, it takes a great deal more study and analysis, more patience and time and a large consideration of the human side of industrial matters.

Managers of industry must do something, however. Prices have to come down. Competition must be faced. Greater efficiency must be secured. Every manager of industry knows that this cannot be secured out of the mechanical equipment improvement by itself. The 150 per cent of overhead is a good place to do some experimentation and analysis.

It should not be necessary to pay for the capital, accounting, office inspection, supervision, and so forth, more than the total actual production from the labor and material standpoint.

It is not likely that we shall do much along these lines so long as we continue to work under the idea that the product is more important than the man. We must begin to get the idea that the product is the result of a more efficient man. Better production calls for better men and better management. Better production is really a by-product of better men and better organization. Mechanical equipment cannot overcome all the difficulties in human variation and all the wastes arising out of human misunderstanding.

A development of larger groups because of the greater value of the mechanical equipment through the co-operative effort of the larger groups will speedily reach its maximum unless the groups themselves are welded into a more definite organization with a larger distribution of responsibility in the proper proportion.

The machinery of industry is capable of being improved very greatly from a mechanical standpoint even to-day, but the speed of improvement will bear a very much smaller ratio to the total volume, so that the individual improvement in the mechanical appliances will not overcome the increasing cost of human failure.

The co-operation of the individual so that the men represent a high standard of efficiency and a large common measure of understanding, the welding of these small groups into larger groups so that the ideal of the whole establishment is translated into the same ideal standard of operation, are matters of much more importance than the development of the mechanical improvement, and the rewards in production efficiency will be considerably greater.

Aircraft Engine Development

IN aircraft engines light weight is one of the important features, though it must not be obtained at the expense of reliability. This applies particularly to engines for commercial airplanes. Tests on the block quickly bring to light all weak points in the design of an engine, provided the materials of construction used were properly tested at the factory as to quality and suitability. But such tests give no indication of parts which could be reduced in weight without injury to the performance of the engine as a whole. It is for this reason that the lightening of water-cooled, 'stationary' aircraft engines, which were developed from automobile engines, proceeded rather slowly.

The development of rotary engines proceeded substantially in the opposite direction. In the design of these it seems that it was the practice to adopt what to educated judgment seemed the lightest permissible dimensions and leave it to practical use to develop the weak points, where it was absolutely necessary to strengthen the construction. In almost every case it was so-called notch points, that is, points with sharp corners or changes in section, where fatigue showed first and cracks developed. This method of gaining experience is rapid but painful and expensive, and it can be followed only if sufficient capital is available and eventual success is fully assured.

It is the opinion of Dechamps and Kutzbach, who deal with the subject in their book on Tests, Rating and Experimental Development of Aircraft Engines (Prüfung, Wertung und Weiterentwicklung von Flugmotoren, Vol. VI, Part 1, of the Handbook of Aircraft Engineering, published by Richard Carl Schmidt) that rational calculations of strength, with consideration of the increased stresses at points of abrupt change in section, would have saved many an expensive experience. Even the dreaded critical speeds of shafts or complete assemblies can be calculated in advance with tolerable accuracy, and trouble therefrom avoided.

The book under review is the result of experience gained during the war at the engine testing plant at Adlershof, Dechamps having been in charge of the organizing work, as general manager, while Kutzbach acted in a scientific advisory capacity. Each of the authors is responsible for a number of the chapters. The following chapter heads give an idea of the scope of the work: Introduction; Testing Equipment; Testing Methods; Results of General Engine Tests; Researches on Changes in Output and Consumption; Contributions Concerning Fuel Feed and Carbureter Development; Contributions Concerning Engine Design; Retrospect and Prospect.

In the chapter on engine design the subject of gear reductions is gone into at considerable length, and a chart is given showing twelve possible designs with three shafts.

Destination of Italian Exported Vehicles

THE destination of the motor cars and trucks exported from Italy is stated in a recent copy of the United States Commerce report. These figures include trucks for the years 1918, 1919 and 1920. A tabulation of the shipments for five years follows:

Countries of Destination	1911	1914	1918	1919	1920
England	939	985	...	144	3,068
Spain	32	36	30	159	1,198
Switzerland	81	219	8	218	983
Belgium	168	17	131	291	608
British India	11	48	1	73	568
France	295	210	2,673	259	451
Turkey	6	36	...	74	363
Argentine	378	131	4	5	332
Holland	46	41	...	36	283
Egypt	5	3	4	35	279
Algeria	...	2	...	235	227
Brazil	153	35	2	14	214
United States	144	217	...	14	209
Portugal	5	22	11	160	189
Norway	...	16	...	134	172
Denmark	...	1	...	74	143
Australia	174	157	1	76	142
Greece	4	73	19	89	106
Germany	24	389	...	...	...
Austria-Hungary	84	103	...	...	*96
Rumania	108	69	...	...	...
Russia	65	156	...	...	...
All other countries	195	325	54	457	1,689
Total	2,918	3,291	2,938	2,547	11,320

*German Austria.

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Decreasing Overhead Costs

CONSIDERABLE time has been spent during recent years in devising systems of factory control and operation. Strenuous efforts have been made to so perfect methods of personnel control that the possibility of human error is reduced to a minimum. These attempts have aimed to remove from the individual the necessity for assuming responsibility; to lay out rules and regulations to cover every possible variation in practice so that under every condition the individual will have a rule by which to guide his actions.

The ultimate development of such a tendency would be to centralize responsibility so narrowly as to make the mass of workers mere machines. The result of such a process means a greatly increased overhead expense, a system of checks and regulations that becomes unwieldy and an enormous increase in the total manufacturing expense.

In proportion as individual responsibility is decreased the cost of supervision increases. It is not an easy task to develop men so that they are capable of assuming a larger degree of responsibility, but efforts along this line pay better ultimately than those in the other direction. A careful study of the human element and an attempt to develop the capabilities of the individual to the highest degree is likely to be a large factor in the reduction of overhead costs in large organizations.

Front Wheel Drive

RECENTLY there has been renewed activity in connection with front wheel drives for passenger cars. Various advantages are claimed for this drive, and its advocates hold it superior to the rear wheel drive now in almost universal use.

In the past the front wheel drive has met with a certain measure of success in connection with commercial vehicles. We need only mention the Latil front drive truck manufactured in France for a great many years, and the Christie front drive which has been exploited on a small scale in this country. In the great majority of the applications the fact that the front drive construction leaves the rear part entirely free of mechanism and permits of placing the body very close to the ground has been of particular value and really the reason for the selection of a front-driven truck or fore carriage. The rear axle, which is a plain or dead axle, may be cranked down between the wheels and the body brought within a foot or less of the ground. Such trucks have been used for the transportation of horses, for instance; and motor fore carriages have also been used for converting horse-drawn fire equipment.

The possibility of placing the body lower down would also exist in front-driven passenger cars, but it is doubtful whether its advantage would be rated very highly. If the rear axle were cranked and the body made sufficiently narrow to go between the crank arms, certainly not more than two persons would be accommodated on the rear seat. Such low seating would, of course, add to the stability of the car at high speed, but, on the other hand, it would bring the passengers closer to the dust of the road, and from this standpoint would be objectionable.

As a rule it is not the possibility of lowering the body that is urged as the main advantage of the front drive as applied to passenger cars. The claim is made that the transmission of power is more efficient in a front than in a rear drive, as the car is pulled along the road instead of being pushed; also that there is less tendency to skid. It is conceivable that under certain conditions power can be applied to greater advantage to the front than to the rear wheels. For instance, if the front wheels are located in a depression in the road, with rear drive there is a tendency to force the wheels into the far bank of the depression, whereas with front drive the wheels have a tendency to climb the far bank. A cross ditch or depression which would stall a rear driven car would therefore not necessarily halt a front drive machine.

It has also been argued that a front wheel-driven car is more efficient in turning corners. This claim is open to doubt, however. In turning a corner, with a properly laid out steering gear, both the front and the rear wheels move in circles around the same axis.

The front wheel tracks have a greater radius, however, than the rear wheel tracks, and with the same gear reduction to the front and rear wheels in cars which are similar except that one has a front drive and the other a rear drive, the front driven one would be able to exert the maximum driving effort on curves. The engine geared to the front wheels, however, would have to turn a greater number of times to complete a certain turn and would therefore do more work if the power output was the same in both cases. The front drive is therefore not really more efficient in this case but it gives the engine a bigger mechanical advantage, which corresponds to a lower gear.

Whatever advantages are offered by the front wheel drive are more than balanced by the complication of driving connections to wheels which have to swing around a vertical axis in steering. Most of the universal joints employed for this purpose introduce a periodic variation in the speed relation of the driving and driven parts, which at high speeds results in heavy strains on the connected parts. It is, moreover, a rather difficult problem to find room for both the engine and transmission in the limited space above the front axle; if the transmission were placed either above or below the engine instead of in line therewith, it would necessitate an additional gearset which would have to carry the engine power at all times, and this would involve power losses probably as great as the gains due to the various causes pointed out.

The Day of Bus Transportation at Hand

THERE are evidences that we shall shortly see a rapid growth in bus transportation in many parts of the country, and some truck manufacturers are preparing to meet this demand by the design of chassis especially adapted for this service. A description of one such chassis appears in this issue of AUTOMOTIVE INDUSTRIES and other articles dealing with various phases of bus transportation will appear from time to time in these columns.

It is important that car and truck builders who expect to enter and remain in this particular branch of automotive activity study the situation with a view to learning the fundamental facts which determine the difference between a successful and an unsuccessful product. It is hardly to be expected that an ordinary truck chassis equipped with a bus body, but devised with little thought for the comfort and safety of the passengers, can hope to compete very long with a vehicle especially designed for bus service. Nevertheless many units of the truck and the bus can be identical or very similar in character.

There may always be a certain percentage of improvised buses or so-called "jitneys" in service, but the public will soon recognize the difference between a comfortable and safe vehicle under competent and responsible operation on a regular schedule and one which is the reverse. Much harm can and has already been done by the latter type in creating prejudice which must be faced and overcome by intelligent education fostered by the manufacturer who is prepared to build and market a thoroughly creditable product.

It is certain that the bus must be made as safe as it is possible to construct it. It should be made comfortable to ride in and easy to enter and alight from. It should be economical to operate, especially as regards fuel consumption and tires, and upkeep cost should be minimized. No vehicle should be sold knowingly for service in which it cannot be expected to operate at a profit with ample allowance for depreciation, for experience gained in uneconomical operation reacts to the disadvantage of the manufacturer.

The sales possibilities in this field have not yet been examined to any great extent. In fact, the potential use of motor bus transportation still constitutes an entirely uncharted field. Efforts to develop in this direction will be of benefit to the truck industry.

These are some of the essentials to be considered by companies which contemplate entering the bus field. There is evidently an opportunity for the manufacturer who is willing to study and analyze these and other factors upon which to build a business and a reputation. Without such an analysis, however, the possibilities of success are minimized.

Use of Cradle Type of Fan Dynamometers

FAN dynamometers have been used in the automotive industry to some extent, but their usefulness has been limited by the fact that the results obtained depend on the atmospheric temperature and pressure as well as on the proximity of walls. Consequently it is impossible to give a simple formula by which to determine the output of the engine from them. This disadvantage of the fan dynamometer was overcome by aircraft engineers, who mounted the engine on a cradle and provided the crankshaft with either a propeller or a club, so that the torque reaction could be measured exactly as in the case of an electric dynamometer. No calibration curve of the fan is then needed. Both the speed and the torque are measured directly and their product is a measure of the horsepower delivered to the fan.

It would seem that this principle could be used to advantage also in automobile engine shops. At any rate, if fan dynamometers are installed, it is desirable to make them of the cradle type so that accurate measurements can be made with them under all conditions. The electric dynamometer has the advantage over the fan dynamometer that the relation between rotary speed and torque can be changed at will while the engine is running, which is not possible with the fan dynamometer, unless the fan be enclosed in a casing with a variable opening at the inlet or discharge. With a dynamometer having adjustable aluminum blades the load can be changed while the engine is at rest. In many respects the fan dynamometer of the cradle type would seem to be the equal of the electric cradle dynamometer, and the disposal of the energy absorbed requires no auxiliary apparatus. The cost of construction should be in favor of the fan dynamometer, especially in the case of small machines. On the other hand, the electric type is much more quiet in operation, and can be used to crank the engine or to drive it when it is desired to measure the friction hp. or to run the engine in.

Good Business Conquers Pessimism

August Sales 70% of Same Month 1920

Prospects Are September Will Be on Par with August—Optimism Prevalent

NEW YORK, Sept. 14—Pessimism which has been apparent in Wall Street for some time in reference to the automotive industry is not justified by actual conditions and has not been since March. August sales, exclusive of Ford, were 70 per cent of sales for August last year and were 2 per cent in excess of July. Business for July was 7 per cent better than in June. Ford sales for this period were larger than ever before in the history of the company.

Prospects are that with Ford, Dodge, Buick and Studebaker as leaders, sales in September will be on a par with those for August. In comparison with other years mid-summer sales of passenger cars were almost unprecedentedly large in relation to the earlier months.

Trucks Improving

While the commercial vehicle branch of the industry is still at low ebb it is gradually improving and there has been apparent in the last few weeks a considerably increased demand for light delivery trucks.

Not only was the vehicle manufacturing end of the business better in August than in July but the same was true of parts and accessory manufacturers. July for them was slightly better than June and August slightly better than July. New orders and releases already received for this month indicate that there will be no falling off. Gradual reduction in tire production may be expected as the touring season comes to an end.

Purchasers of automobiles are being given the benefit of lower manufacturing costs resulting from wage reductions, greater labor efficiency and lower cost of materials. Keener competition also is a factor in price cuts on cars and trucks.

Retailers Hopeful

Retailers and distributors are hopeful, however, that whatever price adjustments remain to be made will be put into effect at once for they believe price stabilization is necessary before there can be stabilization of sales.

In some sections dealers expect the belief of prospects that there will be further price cuts may interfere somewhat with September sales. There is general expectation that after this month business will gradually taper off until the show season in January but this is a perennial condition. There is in prospect an unusually heavy demand for enclosed models of passenger cars. The large number of new models which will be brought out this fall by makers of popular lines also are expected to stimulate sales. These two factors will prevent anything in the nature of a disastrous slump.

Wilmer, New Goodyear Head in California

SAN FRANCISCO, CAL., Sept. 12—E. G. Wilmer has succeeded to the presidency of the Goodyear Tire and Rubber Co. of California, and its subsidiary, the Goodyear Textile Mills Co. The board of directors of the Goodyear Textile Mills Co., on Sept. 3, accepted the resignations of F. A. Seiberling, S. A. Steer, and C. N. Turner, and elected Wilmer, G. M. Stadelman and P. W. Litchfield to fill the vacancies. The new board, in turn, elected Wilmer to succeed Seiberling as president, and declared the quarterly dividend of 1¾ per cent on the preferred stock of the company, payable Oct. 1. Dividends in arrears, it was announced, will be paid when the company's financial situation permits. Following his election as president, Wilmer issued the following statement:

Assets $6,000,000

"After giving due effect to an adequate write-down of inventories, as of March 1, 1921, and offsetting the profits accruing from operations subsequent to March 1, there is an existing deficit as of July 31, of approximately $2,400,000. On the basis of the current costs of operation, made possible by the write-downs of inventories, the company has conducted its operations from March 1 to July 31 at an average profit of approximately $200,000 per month, available for interest and reduction of deficit. The cash and current positions are most gratifying. On July 31, current assets approximated $6,000,000 and current liabilities $625,000, while the company's cash balance was approximately $1,000,000."

NELSON FILES PETITION

DETROIT, Sept. 8—The E. A. Nelson Automobile Co. has filed a voluntary petition in bankruptcy. The liabilities are given as $122,207 including unsecured claims of $119,559. The nominal assets are listed at $501,013 but $432,000 of this amount is credited to patents, copyrights, trade-marks and development work. Cash on hand amounts to $25. The E. A. Nelson Automobile Co. took over the bankrupt E. A. Nelson Motor Car Co. on March 23, 1920.

Fordson Production Is Now 26,000 a Month

200,000th Machine Built at River Rouge Plant—Officials Thoroughly Pleased

DETROIT, Sept. 12—Production of Fordson tractors at the River Rouge plant from March 1 to Aug. 1 totaled 26,000, a showing which the company feels thoroughly satisfied with in view of existing business conditions. In August the 200,000th Fordson was built and will be kept at the plant as an emblem of the growth of the tractor business since its inception.

Despite adverse foreign trade conditions, the company notes that many tractors have been shipped to Canada, South America and other foreign lands, 700 going to Canada alone. A large increase in Fordson business in Europe is being cultivated in view of the improved trade and business conditions there.

Of the Fordsons distributed in the United States in the past five months, Ohio has been the largest buyer, more than 3000 going there. Pennsylvania came second with a sale of 2800 machines. New York State farmers took over 2300 and Michigan and Wisconsin were about even for fourth, each taking about 1800. Indiana came next in the order of distribution and New Jersey seventh. Virginia, Illinois, Massachusetts, Minnesota, California, Washington, Tennessee, Connecticut and Oregon were among the leading States.

Price Reductions Aid Car Sales in Columbus

COLUMBUS, Sept. 12—With the reduction in prices of the Ford, Overland, Oldsmobile, Chevrolet and several other makes, trade in passenger cars in Columbus has been stimulated. All of the dealers who handled the makes on which reductions were made reported a marked increase in demand with business much better than was anticipated.

Other lines have been selling fairly well and dealers report a fair business. When present unsettled business conditions are considered business is better than might be expected.

The unemployment situation in Columbus has improved to a certain extent recently and this has the effect of instilling optimism into the dealers and salesmen. The feeling in industrial circles is improved to a large degree and orders are not quite so hard to land as formerly Prospects for the future are considered fairly good and dealers in passenger cars believe that the fall months will show a considerable volume of business.

$48,000 Damages in Perlman Case

Munger Victorious in Long Litigation

Similar Suits Pending Against Firestone and Goodrich Rubber Companies

NEW YORK, Sept. 12—The Federal Court of Appeals for the second circuit has handed down a decision granting $48,000 damages to Louis D. F. Munger in his patent litigation against the Perlman Rim Co. which has been in the courts several years. After the validity of the Munger patent had been sustained in the higher Federal courts the master who heard the evidence decided that Munger was entitled to $72,000 damages. The defendant then appealed on this point and the Circuit Court of Appeals cut the amount of damages to $48,000.

Other Suits Pending

Munger has similar suits pending against the Firestone Tire & Rubber Co. and the Goodrich Rubber Co. They were filed several years ago but have been held in abeyance pending the result of the suit against the Perlman Rim Co. Now that damages have been assessed in the original action the other suits will be pressed, according to W. A. Redding, attorney for the plaintiff.

The Munger patent expired on Dec. 5, 1916, but suits for infringement can be filed up to Dec. 5, 1922. Damages for the use of the patent which it is alleged has been infringed can be assessed, however, only for a period of five years prior to the filing of the suits. It was said to-day at the offices of Redding that no suits would be started against automobile manufacturers and that no litigation is contemplated beyond that which is now pending.

Years in the Courts

The affairs of the Perlman Rim Co. have been in the courts for years and constitute one of the most dramatic and romantic chapters in the line of litigation connected with the automotive industry. Munger came into the case several years after the Perlman Rim Co. had established the validity of the patent covering the collapsible rims in question. The validity of the patent had been sustained in a suit brought against the Standard Welding Co. by Louis Perlman, and all Munger had to do was to establish his ownership of the patent.

Louis H. Perlman was the first to sue for infringement of the rim which now bears his name. The action was brought against the Standard Welding Co. and was successful. Judgment was obtained against the company for a very large sum and the plant was closed. Not enough rims were being manufactured to meet the demand and W. C. Durant organized a company of which Perlman was president to go into production. This was known as the Perlman Rim Co. The company took title to the patent and also took over the Standard Welding plant under the judgment which had been obtained.

When the United Motors Corp. was formed by Durant it took over the Perlman Rim Co., giving two shares of United Motors stock for one share of Perlman Rim.

When the assets of the Perlman Rim Co. were taken over by United Motors it is understood they assumed all the obligations of the company which they absorbed, and the same was true of United Motors when it was taken over by the General Motors Corp. If this contention by the attorneys for Munger is correct, the General Motors Corp. will be responsible for his judgment.

After his success in the original suit, Perlman brough action for infringement against the Firestone Tire & Rubber Co. This suit was withdrawn, however, before presentation of the evidence had been completed.

Munger Had Patents

At the time the Perlman patent was sustained, Munger had in his possession a collection of patents, and he alleged that one of them covered the Perlman rim. He sued for infringement and before the case came to trial the Perlman action against the Firestone company blew up. Several years had elapsed after Munger obtained his patent before he filed suit against Perlman. When his case went to trial, Munger was asked to explain why he never had manufactured under his patent. He asserted that he had made numerous efforts to do so and had formed several companies but that all of them had failed because of lack of capital.

While the trial was under way, a Philadelphia junkman bought all the assets of the latest of the Munger companies, and the Perlman attorneys contended that the purchase included the rim patent. They went to the junk dealer and obtained an assignment of the patent from him.

When this assignment was presented to the court, Munger produced a contract he had made under which the patent was to be assigned to his company provided a certain amount of capital was invested in it. He showed that this capital was not forthcoming and that failure of his company resulted. For that reason his contention that the patent was not included in the purchase of the junkman was sustained and he won his suit for infringement.

Workers Benefit by Ford Price Cuts

Hundreds of Unemployed Will Work in Parts Plants Now Speeding Up

DETROIT, Sept. 12—Reduced prices in Ford cars and trucks followed a series of negotiations between the company and the companies supplying it with parts, by which new price arrangements were made in practically all cases and orders placed ahead for several months' supply.

Under the stimulus of this business all of these parts suppliers are now operating on an increased schedule, giving work to many men who have been listed among the unemployed for months, and in some cases overtime is being indulged in until the pressure of business is brought to a point where it can be met by regular daily operations.

Many departments of the Ford company which had run ahead of the assembly branches in the latter part of August are now resuming full time operation. Assembly has been at maximum speed since April, but despite this some of the factory departments have from time to time run ahead of actual car production, necessitating temporary layoffs.

In a great many of the factories here orders for some time past have actually warranted an increase in production, but this has been steadily countermanded in an effort to hold operations to a steady day-to-day basis. Under the pressure of continued orders, however, several of these factories are adding daily to their employee organization and are preparing to go into increased production.

D. L. Morgan Succeeds Batchelder in A.A.A.

NEW YORK CITY, Sept. 12—D. L. Morgan, business man of New Haven, Conn., was to-day appointed chairman of the executive board of the American Automobile Assn., succeeding Amos G. Batchelder, who held the position for many years and who was killed in an airplane accident in Maryland last May.

Morgan will devote his entire time to the work and will be located in the headquarters in Washington, D. C. He has been closely associated with motor affairs for eight years. For six years he was with the Lackawanna Motor Club, Scranton, Pa., and for the past two years, while living in New Haven, has organized the Automobile Club of New Haven. In business he has been associated with Bradley-Smith Co., confectionery manufacturers.

Revenue Bill Study Taken Up by N.A.C.C.

Tax Committee Gives Close Consideration to Sections Affecting the Industry

NEW YORK, Sept. 12—The tax committee of the National Automobile Chamber of Commerce is giving close consideration to three sections of the revenue bill now before the finance committee of the Senate to which little attention has been paid previously by the automotive industry.

One of these relates to the manufacturers' excise tax. When the law was first put into effect in 1917 it was construed to cover not only sales at wholesale but retail sales made through factory branches. Remedial legislation was enacted in 1918 to relieve wholesalers of the payment of a retail tax, but this paragraph of the law was omitted in the present House bill, and unless an amendment is made by the Senate, the situation will revert to that which prevailed in 1917.

Another section of the law which would add materially to the bookkeeping burdens of manufacturers provides that every employer must make a report on every employee, whose rate of pay per hour would provide an annual income in excess of $1,000. This would make necessary a report on all kinds of casual labor and would materially increase bookkeeping costs.

The third section to which exception is taken is that relating to the excise tax on tires and automobiles. Although the framers of the measure declare that no change is intended, the phraseology is somewhat different and it is held that new phraseology must always be interpreted and that in consequence it might lead to misunderstanding and inconvenience.

These questions will be taken up with the finance committee if a hearing can be obtained. Letters on the subject now are being sent to individual Senators.

TEMPLAR CARS DOWN

CLEVELAND, Sept. 12—Another cut in prices of $400 is announced by the Templar Motors Co. The open models have been reduced from $2,385 to $1,985 and the closed models from $3,185 to $2,785. The open cars now cost $900 less than on June 30 and the closed cars $1,000 less.

MOON CUTS THIRD TIME

ST. LOUIS, Sept. 12—The Moon Motor Car Co. announces its third price reduction, effective immediately. The prices now are $600 lower than last fall. They are based on 1914 labor, material and overhead costs. The open models have been cut $200 to $1,785 and the closed models $200 to $2,785.

ONE HORSE TO 372 MOTOR CARS AT CONNECTICUT POINT COUNT SHOWS

HARTFORD, CONN., Sept. 12—A count of vehicles made by the State Highway Department for the National Highway Assn. shows, among other things, the remarkable decrease of horse-drawn vehicles. Figures announced to-day, taken at a point in Thompsonville, between this city and Springfield, on the State highway built to meet interstate motor traffic, include 28,039 passenger automobiles, 2395 motor trucks, 334 motorcycles and 83 horse-drawn vehicles, for a certain period of time. This is about one horse to 372 motors.

The count made was one of many initiated by the national association to secure information for use in road building. The men making it noted the character of the trucks, direction of travel, size of tires, freight, and weight on axles. The work was done with the least inconvenience possible to drivers.

Notice was issued before it started to explain that the inspectors were not stopping vehicles to look for liquor nor were questions asked for any ulterior motive.

Hendee Motorcycle Prices Reduced 22½%

SPRINGFIELD, MASS., Sept. 12—The Hendee Mfg. Co. announces a reduction of 22½ per cent in the prices on 11 lines of motorcycles. They are effective immediately. The company is bringing out a new machine called the "Indian Chief" which will sell for $435. The report of the company for the fiscal year ended Aug. 31 shows that more than $900,000 of bank loans were paid off during the year and that current liabilities aggregate only $200,000 contrasted with about $4,000,000 of current assets.

VIM TRUCKS DOWN

NEW YORK, Sept. 12—The Standard Steel Car Co., which now owns the Vim truck, has announced the following new prices:

Model	Old Prices	New Prices
Vim 29.....	$1,355	$1,050
Vim 30.....	1,550	1,175
Vim 31.....	2,475	1,975

BELL TRUCKS DROP

OTTUMWA, IOWA, Sept. 12—A general reduction in the prices of Bell trucks, effective at once, has been announced by the Bell Truck Sales Corp., sales division of the Iowa Motor Truck Co. The prices follow:

	New Prices	Old Prices
Model M 1 ton.....	$1,495	$1,650
Model E 1½ ton.....	2,100	2,250
Model O 2½ ton.....	2,550	2,750

Cleveland Makers Report Increases

Federal Survey Also Shows Greater Demand for Cars Since August 15

CLEVELAND, Sept. 12—Statements by various local makers of automobiles to the effect that the demand has increased gradually since August 15 is borne out by a report of the committee on labor relations of the Chamber of Commerce, on the employment condition in Cleveland. This report was prepared for the United States Department of Labor.

The survey shows that industrial conditions in this city have improved over July, while the retail merchants' board of the Chamber of Commerce has learned that retail buying is on the increase in practically all lines. The retail automobile trade is taking the lead, however, and the large cuts made in the prices is said to be responsible.

The survey of employment disclosed that there has been an increase of 1.5 per cent in the number of employees in August. The concerns covered in the survey number 99, and they are representative of all industries.

Automobile makers reported an increase in employees on Aug. 31 of 2.9 per cent over the last day of July. Iron and steel products are moving more freely in this district, and as a result there was an increase of 3 per cent in employees; food and kindred products show an increase of 7.9 per cent; paper and printing 3.9 per cent; textiles and their products 2.2 per cent; chemicals and allied products 3.9 per cent. The following industries reported losses as indicated: Lumber and its manufacture 6.3 per cent; metals and metal products other than iron and steel 2.4 per cent, and miscellaneous 1.5 per cent.

Railroads in this section are hauling more freight than they have in months. All the trunk lines are putting back trains that were taken off the schedules months ago.

WICHITA TRACTOR CUT

WICHITA FALLS, TEXAS, Sept. 12—Wichita Motors Co. has announced a price cut of $500 on the Wichita tractor, Model T. It will now sell for $2,000.

MAURITIUS A GOOD MARKET

LONDON, Sept. 3 (*By Mail*)—The 400,000 people in Mauritius are very well off and the motor vehicle is becoming more essential to them every day. For tilling the ground only very strong tractors can be used as the soil, though extremely fertile, is very stony. There is some talk of electrifying the island's railroads, but in an island 36 miles by 24 the motor truck is obviously the best means of transport.

Insurance Risks Greater in Cities

Some Few Companies Escape Losses by First Investigating the Owners

NEW YORK, Sept. 12—Discussing the automobile situation, which "continues to be the chief source of worry to the officers of many of the fire insurance companies," the New York *Journal of Commerce* says:

"Here and there is found a company which is not doing any serious worrying. These are mostly institutions which have not sought a large volume, but have applied to the automobile business the same methods they used in underwriting other classes. Realizing that the hazard was in the owner rather than in the car, they have investigated the owners through the "Fire Record," mercantile agencies and various reporting agencies and have kept off their books a considerable business which is now presumably causing sorrow to some of their competitors. They are having more than a normal loss ratio, but they have not to blame themselves for want of care.

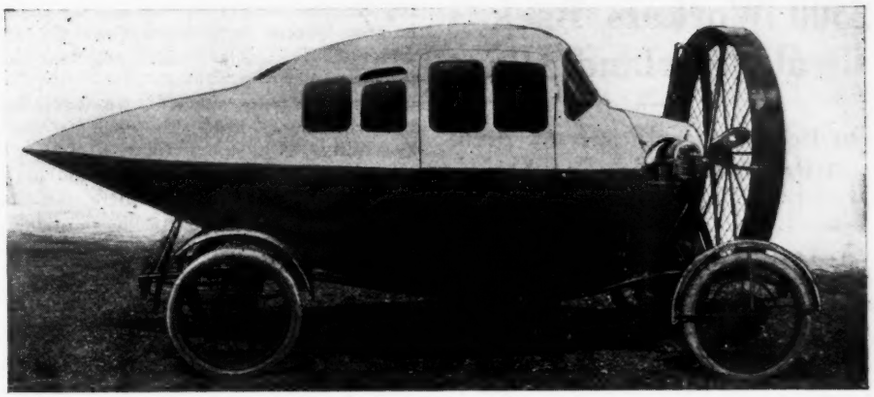
"One noteworthy feature of the automobile situation is the fact that it is so much worse in large cities than in the country and smaller places. After making due allowance for the greater prevalence of crime in large cities, there is still ground for the belief that the better experience in the smaller places is due in part at least to the fact that the agents who underwrite the business know the assured, while in the large cities the underwriter as a rule knows only the broker who presents the risk.

"A wide difference of opinion exists as to the value of inspections on assured. One official says that his company has had excellent results from the Retail Credit Co.'s investigations. An officer of another company says it has secured more satisfactory results through other agencies. Still another company uses the mercantile agencies first because their reports cost less, and then the Retail Credit Co. later, if necessary. That the system of getting reports on owners of cars is growing is evidenced by the expansion of this branch of the business of the Retail Credit Co. Vice-president Walter C. Hill of that company writes:

" 'It is only within the last few months that fire insurance companies have been making anything like regular or systematic use of inspection information. During that time we have opened with nearly a hundred fire companies accounts for investigating automobile fire risks. This includes practically all the big companies. We have never handled any line of reporting in which there is such a large per cent of unfavorable reports. One company has us make a review of all their auto fire business in Kansas City and found it necessary to cancel 17 per cent of the risks on their books. Similar reviews have been made in other communities with approximately the same results.' "

DRAGON UNDER INQUIRY

CHICAGO, Sept. 12—Alleged misuse of the United States mails and violations of the State blue sky laws by the Dragon Motors Corp., a concern capitalized at $1,000,000 are being investigated by Federal and State authorities.



Newest Car on French Roads

A "windwagon" of recent French construction. The La Traction Aerienne is a closed machine seating two persons in tandem and is equipped with a two cylinder aircooled engine of 3.5 by 4.7 in. cylinder dimensions. Vehicles of this type are permitted on French roads provided the propeller diameter does not exceed the maximum width of the vehicle and the propelier is properly protected. The machine weighs 520 lbs.

Willard Now Making All-Rubber Batteries

CLEVELAND, Sept. 12 — No wood enters into the construction of the new all-rubber battery now being manufactured by the Willard Storage Battery Co. The plate assemblies are contained in compartments which are formed by rubber dividing walls which are integral with the molded rubber case. Thread rubber insulation is used. The sizes in which this new battery is being produced and the retail list prices are as follows:

6-volt, 11 plate	$47.30
6-volt, 13 plate	53.90
12-volt, 7 plate	61.95
Ford size	35.00

The price on the Ford size of the new battery is the same as for the thread rubber battery for Fords with wooden case.

INTRODUCE "VAUGHN" CAR

GREENSBORO, N. C., Sept. 12—The American-Southern Motors Corp. is officially introducing its new model, the Vaughn, to the public at the "Made in Carolinas" Exposition this week. The new car has been put to rigid tests the past few months, and the manufacturers are greatly pleased with the showing made. Hiram M. Browne is designer of the new car and he has just given it a 3000-mile drive, having no trouble on the trip. Actual running time was 98 hr. 20 min., an average of 31.58 miles an hour. Gasoline consumption was 13¾ miles per gallon of fuel consumed, weight carried 4950 lb. This car will be presented in two models, a sporting touring car and racing roadster. Another type of the Vaughn will be a family car, presented in three models.

N. I. V. A. TRACTOR SHOW

CHICAGO, Sept. 12—Offices have been opened in the headquarters here of the National Implement and Vehicle Assn. to take up the preliminary work in connection with the seventh national tractor show and educational exposition which will be held on the Minnesota State Fair Grounds at Minneapolis Jan. 30-Feb. 4.

Stockholders Finish Immel Reorganization

COLUMBUS, OHIO, Sept. 12—The reorganization of the Immel Co. of Columbus has been completed by the committee of stockholders, which bought up the plant and all materials recently at receiver's sale. Recently the Buckeye Body Co. of Columbus was chartered under the laws of Ohio with an authorized capital of $1,000,000.

The incorporators are A. G. Gilmour, J. W. Dinsmore, F. E. Kocher, G. P. Hinkle and Willard Miller. The incorporators are members of the stockholders' committee with the exception of the last named who is an attorney. The board of directors consists of J. W. Dinsmore, F. E. Kocher, G. P. Hinkle, A. G. Gilmour, V. W. Moss, J. G. Goeller and C. W. McFarland. J. W. Dinsmore is president, F. E. Kocher vice-president, and G. P. Hinkle secretary-treasurer. The company will soon start active operations at the plant, and a contract with the Velie company will likely be revived.

RICE ADDRESSES M. A. M. A.

DETROIT, Sept. 14—H. H. Rice, president of the Cadillac Motor Car Co. and treasurer of the National Automobile Chamber of Commerce, will discuss business conditions in the automotive industry and prospects for the future at the meeting to-day of the credit convention of the Motor and Accessory Mfrs. Assn. Theodore H. Price, editor and publisher of Commerce and Finance, will address the convention to-morrow on the subject, "Why I Have Faith in the Automotive Industry."

NEW FORD DEALERS IN MEXICO

HOUSTON, TEX., Sept. 12—The Ford Motor Co. of this city has signed up the Robertson Motor Co. of Mexico City as its third dealer in the Federal district of Mexico. New dealers also have been placed in Guadalajara, Zacatecas, San Geronimo, Saltillo and Torreon.

2500 Workers Back at Overland Plant

On Road to Conditions of 1916, President Willys Says in Statement

TOLEDO, Sept. 12—More than 2500 men were put back to work this week by the Willys-Overland Co., at the local plant and 2000 were recalled at the Willys-Morrow plant at Elmira, N. Y. The latter plant makes parts for the Overland automobiles. John N. Willys announced here this week that production would be doubled and more men put back to work.

In the last month reductions have been made in the working forces as the selling activities of the company slacked but with the third price reduction announced last Saturday in effect sales boomed so that a reaction was necessary at the plants.

"I am devoting practically all of my time to Overland in field sales work among the dealers," said Willys, who was in the city this week for a conference with Walter P. Chrysler, executive vice-president and divisional sales manager.

"We have a very satisfied lot of dealers. Personally I believe we are on the road back to conditions as they existed in 1916. Willys-Knight sales have shown a greater increase by three times than have Overland sales."

The first three days following the announcement of the price cuts brought in sales of 3,100 cars and the fourth day before noon 435 orders were booked.

Willys said he was especially pleased with the progress at the factory and the management of Vice-President Charles B. Wilson.

The agricultural fields are looked to for a great buying increase this fall. The harvesting of crops and the lower prices for automobiles will give great impetus to the farm sales, is the opinion of the Willys leaders.

Toledo sales have shown a large increase during the week, according to Leroy Peed, manager of the Willys-Overland, Inc., here.

"We feel that we can make a new record this fall," he said.

L. J. McCracken, who recently established a sales record for Overlands at Bridgeport, Conn., will assume management of retail sales for Toledo, succeeding Lewis P. Kinsey, on Oct. 1. Kinsey, who has been long identified with Overland, is leaving the motor field.

McCracken was formerly in the New York sales office of Willys-Overland.

With the development of new sales policies and the pick-up in sales the last week more activity is reflected in the automotive subsidiary plants here including the Electric Auto-Lite Corp., Tillotson Carbureter Co., Mather Spring Co.

The movement of Willys engineering forces to Toledo has been completed. W. S. Fisher, who has charge of designing Knight motors at the Elyria plant, is now located with his assistants here under E. H. Belden, chief engineer for the company.

The entire sales situation was reviewed at a conference here this week attended by Willys, Chrysler, Charles LeRoux, Minneapolis, northwestern division manager; Walter Wright, southern division manager; R. H. Butler, central division manager; and W. L. Colt, New York, eastern division manager.

O. T. Pearson Becomes N.A.C.C. Staff Member

NEW YORK, Sept. 12—O. T. Pearson has been added to the staff of the educational department of the National Automobile Chamber of Commerce to develop work in economic research. He was a graduate of the University of Michigan and did graduate work at Carnegie Institute of Technology.

Pearson has had a wide experience in research work and his addition to the staff of the N. A. C. C. will permit branching out along new lines. A bulletin will be issued regularly summarizing general business conditions in relation to the automotive industry. This is designed to supplement the work of factory sales departments in economic investigation. The bulletin will be of general interest to the industry and especially to the smaller companies which cannot afford to conduct such a department for themselves.

Portage Stockholders Arrange Stock Issue

BARBERTON, OHIO, Sept. 12—Stockholders of the Portage Rubber Co. have made plans for reorganization and refinancing under new management by the issuing of $1,000,000 in first mortgage sinking fund bonds. Present stockholders will be given first chance to purchase these bonds which will bear 8 per cent interest. The present common stock which has no par value with be withdrawn and new common issued. Creditors of the company and those with which it has fabric commitments will be asked to accept the mortgage bonds. It is expected that E. A. Tinsman, former manager, will be elected vice-president and general manager.

Change Date of Meeting for Service Managers

NEW YORK, Sept. 12—The convention of factory service managers to be held under the auspices of the National Automobile Chamber of Commerce will be held Nov. 15 and 16 instead of Nov. 22, as tentatively planned, as this latter date comes too close to Thanksgiving Day. A questionnaire has been sent to members asking for suggestions as to subjects to be taken up at the convention and it is probable that arrangements will be made to conduct those delegates who are interested through local factories and service stations.

Trade Conditions Better in Canada

A. I. C. Convention Shows Industry Has Demonstrated Stability—Future Is Assured

TORONTO, Sept. 9—At the annual meeting of the Automotive Industries of Canada (the N. A. C. C. of the Dominion) was held in Toronto, reports showed that conditions had been better than anticipated, that the products of the industry had enjoyed a better sustained demand than those of many other industries, thereby demonstrating their stability and the fact that the service they gave was needed and that conditions were bettering and the future assured were the outstanding general opinions expressed. The following excerpts from the "Annual Review" are of interest:

"Statistical data supplied by members of our association show that during the year 1920 a total of 97,868 motor vehicles were manufactured by ten companies belonging to the Automotive Industries of Canada. These companies had a capital investment of more than $43,000,000 and their production values totaled $93,880,864. The figures for the entire industry showed a total of 21,940 employees at the busiest season, a total of $23,826,240 paid in salaries and wages, a capital investment of $87,158,869 and a production value of $157,120,337 for the year 1920.

"In addition there were in 1920 a total of 5522 automobile dealers with 43,094 employees to whom $56,022,200 was paid in wages. The total capital invested by dealers was placed at $44,176,000.

"The number of persons dependent on the automotive industries is shown in the chart as 87,760 and the number of dependents on the retail trade 194,464, a grand total of 282,224 dependents on the manufacture and sale of motor vehicles in Canada."

(These figures do not include service or gasoline stations, garages or repair depots. Were these included it is estimated that the total would be swelled to approximately half a million dependents.)

The 1920 board was re-elected with the exception of W. A. Eden of the Dominion Rubber System, who succeeded R. E. Jamieson of the same corporation. R. S. McLaughlin, president, General Motors of Canada, Ltd., was re-elected president and W. T. Sampson, general manager, Gananoque Spring and Axle Co., Ltd., vice-president.

SUNDRIES FIRM BANKRUPT

NEW YORK, Sept. 12.—Schedules in bankruptcy have been filed by the Automobile Sundries Co., Inc., of this city. Liabilities are listed at $80,026 and assets at $60,789. The principal creditor is the Champion Spark Plug Co., which has a claim for $29,506.

New Firm Will Sell Reimported Trucks

Slough Trading Company Formed to Dispose of 1,000—Only 70 Sold

NEW YORK, Sept. 12—The Slough Trading Corp. of America has been organized as representative in the United States of the Slough Trading Corp., Ltd., of England to dispose of approximately 1000 former American army trucks purchased of the allied governments and sent here for re-sale. W. O. Crabtree, who has been well known in New York for several years as truck dealer, is general manager of the corporation which is seeking dealer representation throughout the United States.

The trucks include Mack, Pierce-Arrow, White, Packard and Riker and range in capacity from 3½ to 5 tons. They will be sold as reconditioned vehicles at approximately one-half the list price of similar new trucks.

The Slough Trading Corp. of America succeeds previous representation of the British company. It will handle only the distribution of trucks, selling through local dealers in New York as elsewhere

Speaking of the project, Crabtree stated his opinion that the truck business in the United States cannot be put on a sound basis until these reimported trucks, which the entire business community knows are here and will be sold sometime, have been disposed of. Up to date less than 70 of the Slough reimportations have been sold and Crabtree feels that uncertainty will prevail in the truck market until the balance of the 1000 vehicles are put in the hands of users.

Crabtree makes no claim that the trucks are "as good as new," stating frankly that some have been operated and others have suffered sufficient deterioration in shipment and storage to necessitate reconditioning.

Ford Plans Car Shops Along His D., T. & I. Road

SPRINGFIELD, OHIO, Sept. 12—After an inspection of the local property of the Detroit, Toledo & Ironton Railroad by Henry Ford, its owner, he said he plans eventually to locate car shops at convenient points along the road so that rolling stock can be repaired without keeping it out of service for long periods. He added that he expects to develop a new type of freight engine to be used on the road.

Intimation that Ford contemplates entering the river shipping business was seen in his statement "that the Ohio River is navigable the year round and business can be handled to and from the South by water. The use of water transportation is coming back and will be developed more thoroughly in the future."

Ford has been asked to purchase the defunct Missouri & North Arkansas Railroad when it is sold at public auction next month. The road is 364 miles long and extends from Joplin, Mo., to Helena, Ark., passing through a heavily timbered country containing large deposits of manganese. Ford has not indicated whether or not he will bid for the property.

Canada Gets Gasoline Supply from Roumania

WASHINGTON, Sept. 12—Gasoline is being brought from Europe to Canada and arrangements are likely to be made for a continuous supply from Roumania, according to a report received from Consul Felix S. S. Johnson, Kingston, Can. This gasoline is being sold at service stations in Montreal at a price of one cent per gallon less than the prevailing retail price, and arrangements are said to be under way for a continuous supply by tank ships from the same source. Establishment of this trade with Roumania will in a measure offset the indebtedness of that country to Canada as the result of war loans.

It will be somewhat unique for Canada to obtain her supplies of gasoline from Europe as many interesting points are involved, such, for example, as the quality of the product, the consul states, in view of the existing Canadian tariff which seeks to bar out high grade gasoline as a protective measure and also as to the effect on prices in Canada of such importations.

Car and Cycle Clubs Plan British Race

LONDON, Aug. 31 (*By Mail*)—The Junior Car Club, which was founded in 1912 as the Cycle Car Club, will conduct a 200 mile race on the Brooklands track, Oct. 22. It will be open only to members of the club, but will be held under the rules of the Royal Automobile Club. The race is divided into two classes for motor propelled vehicles. The first class will be for cars under 67.2 cu. in. and class two for cars between 68 cu. in. and under 91.5 cu. in. The race will be the first of its kind ever held in England. Fifty-one cars have been entered, representing 27 makes, of which 13 are in class one.

Steel Treating Men Will Witness Races

INDIANAPOLIS, Sept. 13—The Indianapolis Motor Speedway Co. has offered the use of the speedway track for the entertainment of delegates and members at the convention of the American Society for Steel Treating on Sept. 21. A 100 mile race has been planned and a two mile match contest between two cars owned by Arthur Chevrolet will be features of the day. Drivers who will take part in the races are Jimmie Murphy, who won the French Grand Prix; Howdy Wilcox, Roscoe Sarles, Benny Hill and Eddie Hearne.

Duplex Truck on 50% Production Basis

Company Expects Soon to Run at Capacity—Sales Have Been Good

DETROIT, Sept. 12—Operations at the Duplex Truck Co. factory, Lansing, have increased to a 50 per cent basis through the development by the company of the possibilities of its 1½ to 2 ton chassis for passenger bus service in meeting transportation problems in many parts of the country.

Though not confining itself to the production of this one chassis exclusively, the company is going after this business aggressively and declares that with present prospective business taking form it will soon be back to practically 100 per cent operation.

The business is sought out by its investigators in the field operating under the vocational sales plan. Where an opportunity for bus transportation is reported the dealer in that territory is asked to investigate further. If conditions are regarded as favorable for actual bus trial, one or more are put into service and the possibilities of the proposed line tested out. Where the institution of a line follows trial the sale is made through the territory dealer.

Recent business developed by the company includes the sale of 16 additional buses to a fleet of 14 which has been operating in Washington, D. C. A line is operated between Elkhart and South Bend, Ind. Trial buses are in operation in a number of cities with excellent prospects of developing permanent lines.

Champion Porcelain Company Organized

TOLEDO, Sept. 12—The Champion Porcelain Co. has been organized here by the Champion Spark Plug Co. to take over the business of the Jefferry DeWitt Co. of Detroit. The new corporation is capitalized at $750,000 under the laws of Michigan.

For many years the Champion Spark Plug Co. held an interest in the Detroit concern which manufactured insulators exclusively for Champion. Recently a deal was consummated whereby the Toledo company gained complete ownership of the Jefferry firm. The Champion Porcelain Co. is a subsidiary of the spark plug company. Dr. J. A. Jefferry is president of the new corporation and is known as a leading ceramic engineer.

LOUIS F. KAUFMAN DIES

INDIANAPOLIS, Sept. 13—Louis F. Kaufman, 67 years old and for several years manager of the service department of the Midwest Engine Co. of this city, died at his home here following an illness of many months. Surviving him are a widow, one son and a brother.

Durant of Canada to Make Own Tires

In Fact Every Part Used Will Be Manufactured at Leaside Factory

NEW YORK, Sept. 12—Preparations are being made for the incorporation of Durant Motors of Canada, Ltd., for which a plant at Leaside, near Toronto, was purchased last week by W. C. Durant. Plans for the Canadian company have not been completely developed but they have been so far formulated that it can be said they are of great importance from the viewpoint of the Durant enterprise.

The plant which has been purchased was erected by the American Government for a munitions plant. It was completed almost simultaneously with the armistice and never was occupied. The site includes 18 acres and plans already have been made for the erection back of the present building of a three story assembly plant 600 feet long and 130 feet wide. The building which has been purchased will be used for the manufacture of motors, axles and differentials. There also will be erected a woodworking plant for the construction of bodies. It also has been learned that the Durant interests will manufacture in Canada the tires which will be used on the car made there. In fact every part used will be made in Canada including the electrical equipment.

While no official information is obtainable at Durant headquarters, the natural inference is that if all the parts which go into the Canadian car, including tires, are to be made by Durant, the same procedure ultimately will be followed in this country. The Canadian plant will be put in operation next March with a capacity of 100 cars a day. Durant four will sell in Canada for $1,280 f.o.b. Toronto. The price in the United States is $890.

The Durant four already is in production at the Long Island City plant and a few already have been turned over to purchasers. Production will be increased steadily.

Marked progress is being made in redesigning the Sheridan which will be known as the Durant six. The body lines will be similar to those of the Durant four.

Anglo-American Motor Settles on Plant Site

TRENTON, ONT., Sept. 12—The board of directors of Anglo-American Motors, Ltd., has finally closed with the town of Trenton for a site for its plant, where it will build the "La Marne" car. This means a boost for industry in Trenton, as the factory will be a large one, employing several hundred men. The company will manufacture two types of automobiles—a four and an eight cylinder model, both with closed bodies. The car will be Canadian-built throughout, and the manufacturers claim that the price will be less than any car of the same size and quality now being made in Canada.

They propose to sell the small four cylinder car for $975, and the eight for $3,000. If this can be done, the car should have a huge sale when it is put on the market. Construction work on the new plant will be started in the course of the next few weeks, and the machinery will be installed as the work progresses. The head office of the Anglo-American Motors is in Toronto.

Rural Buying Gains in Indiana District

INDIANAPOLIS, IND., Sept. 12—The Indiana farmer is buying trucks. He also is buying tractors. And with some other folks he is buying passenger cars. And this is in face of the very discouraging stories circulating about Indiana crops in general, and despite the particular story that the Indiana farmer will have to buy potatoes for his own use and at a rather high figure. Exhibitors at the Indiana State fair last week, after the first three days, were trying to outboast one another on the amount of automotive equipment sold. Boiled down to even 25 per cent of their face figures, these boasts indicate something of a record run of business for the fall motor show, the twenty-third annual event staged by the Indianapolis Automobile Trade Assn.

Departing from the old "still" exhibits, the tractors and some of the trucks gave power demonstrations, control and flexibility trials. And the answer was found in the difference between the interest of the small "lookers" in the still show inside, and the "questioners" in the close packed groups at the motion show under tents and in the open.

California Has Heavy Registration Total

INDIANAPOLIS, IND., Sept. 12—The registration of motor vehicles from Jan. 1 to Sept. 1 was 42,053 more than was registered with the Secretary of State all last year, H. D. McClelland, superintendent of the automobile division in the State office, has announced. The eight months' registration of passenger cars was said to be 35,622 more than the entire 1920 registration of such cars. The truck registration in the eight months exceeded the entire 1920 truck registration by 6,431.

FEDERAL TRUSTEE NAMED

WESTFIELD, MASS., Sept. 12.—Loring P. Lane of this city has been appointed trustee in the estate of the Federal Corp., local manufacturers of automobile accessories, as a result of the first hearing of the corporation's creditors before Referee Charles W. Bosworth in bankruptcy court at Springfield. The liabilities of the corporation are listed at $282,908.27 and the assets are placed at $62,544.08.

Cadillac Back on 20,000 a Year Basis

Production Schedule Now Represents Practically 100 Per Cent of Capacity

DETROIT, Sept. 10—Cadillac Motor Car Co. has resumed production on a schedule as great as that of last year, it was announced at a convention of Cadillac's 100 distributors at the factory this week. In 1920 annual production was on a basis of 20,000, representing practically 100 per cent capacity.

"Indications from all parts of the country," said H. H. Rice, president and general manager, addressing the convention, "show generally improved conditions affecting the purchase of motor cars. Business men can look for a more receptive mood from the buying public from now on. We believe the bottom has been reached and that real recovery is actually in progress almost everywhere."

The distributors were taken on an inspection trip through the new plant and were much impressed with the company's preparation for better business. In their remarks it was indicated that complete confidence dominated the sales organization of the market awaiting the Cadillac fall offerings.

Parker Motors Leases Montreal Plant Space

MONTREAL, CAN., Sept. 12—The Parker Motor Car Co., capitalized at $10,000,000, has leased factory space sufficient to provide for the assembly on a considerable scale of its car which will be called the Royal Six. It is understood operations will be started the last of this month. The company has completed negotiations with the Canadian Motor & Machine Co., Ltd., at Quebec whereby it will take over the plant of the latter company to establish a distribution and service center for eastern Canada. Small units eventually will be manufactured in the Quebec plant.

W. A. Paterson, Pioneer of Industry, Dies at 83

FLINT, MICH., Sept. 12—Through the death of William A. Paterson the automotive industry has lost one of its pioneers. He was the founder of the W. A. Paterson Co., manufacturer of carriages since 1869 and manufacturer of the Paterson automobile since 1908. Paterson was born in Fergus, Ont., in 1838. He came to Flint in 1869. The carriage business was discontinued in 1910, two years after his advent in the automotive field. Affiliated in the company with him were W. C. Paterson and W. R. Hubbard. Business will be continued along existing lines and no action will be taken at present in regard to a successor to him as president of the company.

1922 Cadillac Will Have Many Changes

Improvements in Body, Chassis and Powerplant—New Model in Production

DETROIT, Sept. 15—Changes in body, chassis and powerplant are incorporated in the 1922 Cadillac. Refinements throughout have been designed to produce a lower car of better riding qualities, enhanced appearance, increased efficiency in performance, particularly in cold weather, and superior appointments in both the closed and open bodies. The price remains unchanged. The factory is already in production on the new model and shipments have commenced.

Lower Appearance

Probably the most striking difference between the new cars and the old is the lower appearance, which is secured by the use of smaller wheels using 33 by 5 in. cord tires, and by the use of the longer wheelbase for some of the body types. All Cadillacs are now mounted on the same 132 in. wheelbase chassis. Former models varied the wheelbase with the body, using considerably shorter lengths for some of the open cars. A higher radiator, larger hood, and new design head lamps are provided.

Some mechanical changes of considerable importance are incorporated. Probably the most noteworthy of these is a new carbureter designed for better economy. It has a 2-in. intake and employs a thermostatically controlled spring on the auxiliary air valve, which is designed to provide temperature compensation in the regulation of the mixture. The action of the throttle pump is also controlled by thermostat to provide a richer mixture for acceleration when the engine is cold. Both these improvements are claimed to be helpful in reducing the warming-up period.

The oiling system has been simplified by doing away with the camshaft bearing feed pipe and allowing the oil to circulate through the center of the hollow shaft. This gives a cleaner design and takes care of not only the camshaft bearings but also the front end driving chains and the air pump for the gasoline system. Lubrication of the chassis is improved by the installation of piston type grease cups capable of introducing lubricant under 400 lb. per sq. in. pressure and thus keeps a constant supply of lubricant in contact with the bearing. No lubrication is now required on the bushings for the clutch and brake pedal shafts, and a number of other points where the installation of bronze bushings with graphite inserts has been found practicable.

Changes for Comfort

Most of the remaining chassis changes are of a more detailed nature and do not so materially affect the performance of the car, but rather its period of useful life and comfort. A choice of gear ratios is now provided. The standard ratios are 4.50 to 1 and 4.90 to 1, but if desired there is also a 4.15 to 1 which can be secured on the phaeton or roadster.

Other detail changes on chassis include such conveniences as drain cocks on the bottom of each water pump accessible from above the frame, by means of long shaft connections. One particularly noteworthy point is that the road clearance has not been decreased although the car is lower. This has been accomplished by decreasing the size of the rear axle gear housing, which is the low point of the chassis.

In the bodywork and fittings there are a great many important refinements which result in better appearance and more comfort. The steering wheel, for instance, is now made of selected walnut, including the spokes. The horn button also is of the same wood and the tilting feature, which is no longer regarded necessary, has been eliminated. The long spark and throttle levers have been replaced by a more compact arrangement which eliminates the sector and brings these control features closer in to the steering column. Only the finger grips of the new levers are exposed.

Instrument Board

The new instrument board is distinguished by its beauty of design and brings together all of the dash equipment in one assembly. All the devices on the instrument board are retained by thumb nuts to facilitate removal. The pedal pads are duralumin forgings and consequently non-rusting. To keep the clean design desired in the front compartment, the pedal adjustments have been discontinued.

There is a transmission lock fitted by the same key as the switch lock and the tire lock. The ventilator is larger and more easily operated; the windshield frame has been strengthened and a leather covered visor is used on the enclosed cars. The phaeton and five-passenger sedan are provided with trunk racks which fit between the tire carrier and body.

Design Remains Same

The fundamental specifications of the Cadillac and the basic features of the design remain the same as in the past with the changes noted herewith. The eight-cylinder V engine, which is now in its seventh year of manufacture with modifications made from time to time, is continued. The bodies supplied are ten in number and are listed with their prices herewith:

Phaeton	$3790
Roadster	3790
Touring car	3940
Two passenger coupe	4540
Victoria	4540
5-passenger coupe	4690
Sedan	4950
Suburban	5190
Limousine	5290
Imperial limousine	5390

Plan to Reorganize P. O. Transportation

Postmaster Hays Intends to Increase Efficiency by Use of Motor Trucks

WASHINGTON, Sept. 14—Reorganization of the motor transportation system in the Post Office Department has been authorized by Postmaster General Hays. He has designated Ralph H. Matthiessen, president of the Motor Haulage Co. of New York City, as a special assistant in charge of the Bureau of Motor Vehicle Transportation, which will be established. It is the purpose of the Postmaster General to increase the efficiency of deliveries by motor trucks and to reduce the cost of transportation.

Conference Planned

Matthiessen will confer with the automotive experts in the employ of the postal service and with manufacturers supplying trucks and cars to the government; he will reorganize the repair shops and expand their facilities through employing expert mechanics and garagemen. It is the intention of the Postmaster General to install a cost accounting system in order to determine the cost of operating the motor vehicle service. The latest labor-saving devices will be installed in the post office garages in the various cities.

In 271 Cities Now

There are now 271 cities in which Government-owned motor vehicles are operated, maintaining over 3600 motor vehicles. Its operating expenses annually amount to about $15,000,000. There are nearly 5000 supervisory officials, clerks, chauffeurs, mechanics, etc., employed in this class of service. There are used for these trucks about 25,000 tires each year.

The motor vehicle service extends only to mail service within cities, such as collection and delivery of mail and transportation of mail from one point to another within cities. Rural carriers and contractors on star routes in rural territory operate their own motor vehicles.

Hays Explains

Hays said: "The Post Office Department began operating its own machines on a small scale with the establishment of the parcel post. Its great expansion has been made possible through the large number of motor trucks received from the War Department.

"The growth of this motor service occurred under abnormal conditions, such as produced by the war, and the tremendous growth of parcel post. Each large city built it up as a separate unit with a minimum of uniformity. Some few cities have splendid organizations and efficient service; many have been inferior and wasteful, due to lack of more uniform supervision."

Mexican Business Growing Steadily

Reports Reaching New York Say Conditions There Are Exceptionally Good

NEW YORK, Sept. 12—The automotive business in Mexico, with Ford as the leader who is opening up additional sales districts and pushing business in the older automotive centers of the southern republic, is extraordinarily good, to judge from all reports reaching New York. The Ford assembly plant at Houston, Tex., which handles all Ford business to that country, has just completed additional large shipments to both Mexico City and Tampico. The latter point is the center of the oil territory, and is booming again after the recent settlement of the oil export troubles.

These new shipments, made early this month, consisted of a trainload of Ford cars and trucks, consisting of 340 vehicles, to the Cia. Universal de Automoviles, S.A., in the Mexican capital, and a boat load of 100 cars and trucks to the Mayfield Auto Co., S.A. The shipment to Mexico City was handled as a special train and was subjected to no delay.

Owing to the freight rate charges, the Houston plant has effected new loading arrangements and completed touring cars were packed eighteen to a forty-foot car. This was three more than the previous loading. Fifty of the Model T chassis were likewise loaded into a single car, fifteen more than previously had been the case. The shipment to Tampico consisted of completed cars, equipped with Martin-Parry bodies, and were loaded under their own power.

Further comment upon the present situation in Mexico is contained in a letter from the Mexico City manager of one of the larger New York companies. Under date of Aug. 31, writing from the capital, he states "the automobile industry is not suffering in any way from lack of business just at present but rather from inability to secure enough cars."

Mexico was the chief buyer of American-made cars and trucks of all foreign countries during July, and reports from the exporters here indicate a continuation of the movement through August.

Must Endorse Notes of Financing Firms

WASHINGTON, Sept. 12—Under a ruling issued by the Federal Reserve Board to-day, notes issued by a company engaged in financing the business of manufacturers are not eligible as commercial paper unless made or indorsed by a party to the commercial transaction out of which it arises. This decision covers any manufacturer who, desiring money for use in business for the purpose of paying for or carrying goods, enters into an agreement with the financing company that in exchange for a promissory note he will place the company in funds to meet the note at maturity and in the meantime pledges his merchandise to the company as security for his undertaking. The company then executes a note to its own treasurer, who indorses it in blank and delivers it to the manufacturer.

The question upon which the Federal Reserve Board was asked to rule is whether these notes are eligible for rediscount by Federal Reserve banks from the member banks which have discounted the notes for the company's customers. After giving the matter careful consideration the board ruled that these unindorsed notes could not be eligible.

"In the board's judgment, the spirit of the express requirement that paper to be eligible must arise out of a commercial transaction is not complied with in the cases where the sole party liable upon the paper is the person who has obligated himself for the accommodation of the party to the commercial transaction, even though the accommodating party is adequately secured and has a specific contract requiring the party to the commercial transaction to provide funds to meet the paper at maturity."

N.A.C.C. Insurance Board and Underwriters Meet

NEW YORK, Sept. 12—The insurance committee of the National Automobile Chamber of Commerce and a committee representing the Automobile Underwriters Conference held a joint session here to-day to consider the evils which have grown up in automobile insurance. The N. A. C. C. committee presented to the underwriters additional facts in relation to its contention that the moral hazard has been ignored by the underwriters and that in countless cases cars have been insured for more than their value. There is evidence that the underwriters are beginning to recognize the validity of the N. A. C. C. contentions and that there is a gradual trend toward placing more emphasis on the character of the applicant for insurance.

Mercer Refinancing Has Been Completed

NEW YORK, Sept. 12—Reorganization of the Mercer Motors Co. has been completed by the private sale of $2,000,000 in 7 per cent, 4 year notes, and $500,000 in 20 year first mortgage bonds. In addition, 100,000 shares of voting trust certificates have been disposed of, making 200,000 shares of these certificates outstanding. The corporation's balance sheet shows current assets of $2,265,767 and current liabilities of only $334,107. Since there are no sinking fund provisions attached to the notes and bonds the company will not be called upon to pay off any of this debt for at least four years.

Shippers Protective League Is Organized

Will Supply Armed Guards for Motor Trucks Running Between Cities

NEW YORK, Sept. 12—In order to insure against theft of goods carried by trucks in inter-city haulage, a prominent firm of underwriters in this city, Farjeon Ballin & Co., has taken steps to safeguard the load so carried.

This firm has organized an association called the Shippers Protective League, which supplies armed guards for trucks running between cities. The insurance company has also inserted a clause in its theft insurance policy stipulating that the trucks on which goods are insured shall travel in a convoy and shall be accompanied by the armed guards.

Want States Aid

Finally, through various merchants' associations, this company is endeavoring to enlist the co-operation of the State constabularies in patroling the roads where thefts have occurred and where thefts may be expected, such as the direct roads between New York and Philadelphia and between New York and Boston.

Losses Bring Action

This move is a direct result of the tremendous losses suffered by insurance companies in recent months through the theft of goods so carried. In one week two different trucks were held up by armed bandits and their cargoes, valued at $40,000 in each case, were stolen. Many insurance companies, when the risk involved in such policies became apparent, either charged prohibitive premiums or refused to include the theft and pilferage item in writing insurance on truck cargoes.

Plan Factory Branch for Anderson in East

ROCK HILL, S. C., Sept. 12—The Anderson Motor Car Co. has decided to open a metropolitan factory department in New York with every facility to aid its Northern distributers and dealers. The headquarters in New York will be in charge of Charles B. Shanks, vice-president of the company, who took charge of the sales division on July 1.

The plans of the company comprehend maintaining in New York a stock of cars for the needs of the New England States, New York, New Jersey, Delaware, Pennsylvania and Ohio. A complete parts stock for all present and past models will be kept on hand and service men from the factory will be stationed in New York.

The New York factory branch is expected to bring about a healthy increase in sales and will employ a large number of workers.

Cotton Boom Proves Tonic to Industry

Atlanta Distributors Say It Will Bring Return of Normal Conditions

ATLANTA, GA., Sept. 14—The tremendous boom in cotton prices during the early part of September has proven one of the best tonics for the automotive industry throughout the South and will, it is the consensus among the Atlanta distributors, serve to rapidly bring the industry back to its normal status if the cotton prices now existent hold to that point for any length of time. In actual money volume the increase of more than $40 per bale during the early part of the month means something like $300,000,000 on this year's crop alone, to say nothing of the millions of bales of last year's crop that are still being held on southern farms and in the warehouses. With one of the shortest cotton crops in history there is little prospect of prices lessening for several months, while there is every indication that the staple will likely reach 25 cents per pound before the end of September.

This increase in cotton prices not only materially elevates rural buying power so far as the automotive industry is concerned, but it has its very favorable effect on every line of commerce and industry throughout the entire South, primarily the retail business. It therefore increases the buying power of commerce and industry at the same time and this, it is the opinion of the various distributors, will have the effect of materially stimulating the truck and commercial motor car business.

Automotive sales during August—and this was before cotton began its big advance—were better in this section that they have been in many months; and now with cotton having reached a substantial price September business in the automotive field will undoubtedly surpass the volume of any single month in more than a year. Already the advance is stimulating sales among the smaller dealers in the communities that depend mainly on rural trade, and marked improvement also is noted in the larger centers.

Seek Co-operation of Bureau and Trade

NEW YORK, Sept. 12—Plans for effective co-operation between the motor vehicle industry and the newly created automotive division of the Bureau of Foreign and Domestic Commerce have been discussed by Gordan Lee, chief of the division and William I. Irvine, automotive trade commissioner with George F. Bauer, foreign trade secretary of the National Automobile Chamber of Commerce.

Means are being provided for the prompt preparation and distribution among manufacturers of specific data bearing upon foreign automotive markets. With constantly changing conditions this service will fill a long felt want and enable manufacturers to conduct sales campaigns more effectively and opportunely.

Plan Intensive Studies

It is planned that the activities of the new division will cover the more rapid distribution of monthly trade statistics, the preparation of reports based upon data received from the 600 agents of the Bureau of Foreign and Domestic Commerce, intensive studies of overseas markets and co-operation with manufacturers for the betterment not only of foreign trade but of domestic trade as well.

Just as soon as the division is organized fully, Irvine plans to get in direct touch with the export departments of the motor vehicle maunfacturers to get their viewpoint of the nature of the information required of overseas automotive markets. This information will serve as a guide for the series of surveys which he will undertake in all automotive selling markets.

Bull-Madison Assets Go to Bondholders

INDIANAPOLIS, IND., Sept. 12—Final disposition of the assets of the Bull Tractor-Madison Motors Corp., of Anderson, bankrupt, has been made by Harry C. Sheridan, referee in bankruptcy, in a ruling that Charles H. Jocknus of New York and John F. Green of St. Louis are entitled as bondholders to the proceeds from the sale of the property of the corporation. Hearing on the claims of the bondholders and of general creditors have been completed before the referee. The amount of the fund that has been held in the Union Trust Co. by Fred C. Dickson, trustee in bankruptcy, is $120,000, practically all of which was claimed by Jocknus and Green.

The referee heard the claim of J. W. Sandsbury and the National Exchange Bank, of Anderson, that they were entitled to part of the fund through implied contracts, even though Jocknus and Green were conceded to be bona fide bondholders. Their claim was for about $20,000. The Citizens Savings and Trust Co. and Wilbur M. Baldwin, trustees, of Cleveland, claimed $6,400. The referee decided that the claims of the bondholders superseded the claims of those creditors whose claims he ruled, were general creditors' claims.

Bankruptcy proceedings were filed against the Bull Tractor-Madison Motors Corp., with property in Anderson and Minneapolis, Minn., in July, 1920. The trustee in bankruptcy sold the assets of the corporation in November to Goldstein Brothers of Philadelphia. The plants of the corporation have not been operated during the time of the litigation. Settlement of the title to the funds held by the trustee in bankruptcy, closes the case, except for formal orders, to be made by the referee.

Steady Sales of Cars in Latin America

Automotive Business in Pernambuco Grows Despite Commercial Depression

PERNAMBUCO, BRAZIL, Aug. 9 (By mail)—Despite the fact that Pernambuco has suffered from the commercial depression, as have other Latin-American cities, there has been a steady sale of automobiles here, particularly of two makes that have been well introduced. It is believed that there are at least 100 more cars and trucks in the State of Pernambuco than there were last December.

The registrations here this month were 633 automobiles, 173 trucks and 15 motorcycles, a gain of 46 trucks and 7 motorcycles since December. An apparent decrease in the number of passenger cars is not correct, as their registry is frequently delayed and the complete number is rarely registered before the end of the year. In the States of Pernambuco, Alagoas, Parahyba do Norte and Rio Grande do Norte, the total is believed to be 1310, consisting of 160 trucks and 1150 cars.

Depend upon Trucks

It is rumored that some of the big construction companies now engaged on irrigation dams in the drouth-stricken regions of Northeastern Brazil will depend to a certain extent upon trucks for transportation of construction materials from the railhead to the site of the dams. If this is true, it will imply the importation of a considerable number of trucks and probably some passenger cars. These vehicles probably will be used in the State of Ceara.

New Models Lacking at Indiana Plants

INDIANAPOLIS, IND., Sept. 12—Present indications here lead to the belief that new models of Indianapolis made cars the coming year will be singularly lacking. Indianapolis manufacturers seem to be getting away from the new model idea to some extent, most of the effort being spent on improving present models. So far as can be learned not a new model is scheduled for this year except the new sedan of the H. C. S. Motor Car Co., announcement of which has already been made. Some of the plants are planning slight body changes although they are not ready to make known what the changes will be, yet it is certain they will be so slight as to make virtually no difference.

The September business, judging from factory sales, will be better than August with most of the plants. The Lafayette Motors Co. is putting out an average of five cars a day and officials of the company state that at the present time the plant is 100 cars behind orders, with the general outlook very promising.

America in Strong Position in Europe

Returned Automotive Representative Says Americans Do Not Have to Fear Competition

NEW YORK, Sept. 12—American automotive manufacturers have little to fear from European competition in the foreign markets of the world, provided the Americans go out energetically to hold and to develop further the markets that already have been opened for them. This was the statement made by C. H. Jerosch after returning from a trip to England, Holland, Belgium, France, Spain and Portugal, in the interest of the automotive lines on which he handles the foreign sales.

Have Inside Track

"The American manufacturers are in a strong position to go after business on a post-war basis," he said. "It is true that every kind of anti-American propaganda is being spread and this must be countered by our manufacturers. Also, the European manufacturers have an extensive propaganda under way in regard to their own products. But their cars and trucks are not comparable to those of this country; manufacture is conducted along different methods, and practically nothing in Europe can compete with our medium and lower-priced cars. The higher-priced cars have more direct competition but this can be overcome by those makers who will go into the foreign field with an honest and careful merchandising policy."

Jerosch believes that Spain is the most attractive country for the automotive exporter on the Continent. This excepts England, which, of course, has developed the automobile much farther. Spain is a rich country whose economic condition is such that exchange should right itself and whose automotive development has no more than begun. The automobile dealer in that country is generally of the younger type, ready and quick and appreciative of better merchandising methods. Road building is beginning, service stations and garages are becoming more numerous and a start has been made in the distribution of automotive fuel along the lines in use in this country. The Spanish tariff situation in regard to cars has been generally misunderstood, not only among exporters here but as well among the dealers there. It is not the stumbling block that is believed and, in fact, favors American imports over those from other countries.

Educational Work

Further educational work in regard to service is needed in Spain, as it is in all parts of Europe. Likewise, the Spanish automotive trade is being built up along the American lines, although in this the start only has been made. A large body of dealers already has been formed there and, while there has been much to complain about regarding the treatment received from many American exporters and manufacturers, the proper kind of representatives can more than overcome these drawbacks.

Spain Will Compete

Spain will complete its post-war adjustment much quicker than most of the other European countries, as it has no great war debt and exchange will better whenever the demand returns for Spanish products. The result will be further large sales for those American manufacturers who will go after this business in an intelligent and conscientious way.

Jerosch also was enthusiastic about the sales possibilities in Europe of the light car, with small cylindrical capacity. Europe is turning to such vehicles because of horsepower taxation in several countries and because of fuel economy.

Texas Dealers Show October 8th to 22nd

DALLAS, TEXAS, Sept. 12—Forty different makes of automobiles, a dozen different brands of trucks and a variety of automobile accessories, tires, etc., will be displayed at the annual automobile show of the Dallas Automobile Trades Association held in connection with the State fair of Texas here Oct. 8 to 22.

The forty different makes of automobiles means probably more than 150 cars will be on display while it is certain that a score of trucks and trailers will be exhibited. Every space in the big exhibition room at the fair grounds has been taken and many of the dealers here and out of town were not accommodated. In connection with the automobile show some of the leading men in the industry in America will be in attendance. Many of the exhibitors, through Dallas distributors, will bring special built cars for the show, it was said. These will be shown the retailers who are supplied through the Dallas distributors.

Expect 1,000,000 to Attend

In as much as the attendance at the fair will be more than a million the dealers of Dallas are expecting a wonderful improvement in the trade in this section as a result of the show. They expect to close many deals during the show at the show rooms and more of them at their down town places of business where expert salesmen and demonstrators will be at the beck and call of the men in charge of the displays.

Dealers are attempting to hurry up shipments of cars to be disposed of during the show. Some of the retailers of Dallas expect three hundred new cars to be disposed of as a direct result of the show and as many more to go before the first of December. The dealers will keep an index list of all prospects obtained at the show and keep everlastingly after them after the show until they own some kind of automobile. The show is expected to result in sales improvement throughout the territory.

Radical Insurance Changes in Chicago

New Rule Insures Cars Only Up to 90% of Total Value for One Year

CHICAGO, Sept. 12—Radical changes in its method of writing automobile insurance have been announced by the Firemen's Fund Insurance Co. Agents are being advised of a revision in the acceptance limits on automobiles and a change in the general conditions under which such insurance may be written.

Within recent months the fire feature in automobile insurance has come to the front with unusual force and theft risks are no longer considered the source of only loss. Losses from both causes are no longer confined to large cities but are spreading through the rural districts in such number as to cause alarm.

Under the new rules cars will be insured for not more than 90 per cent of their list price, irrespective of freight, war tax and the ordinary equipment. Second-hand cars will carry not more than 80 per cent of their purchase price; full particulars must be furnished on all mortgaged second-hand cars. Used cars in the hands of the original owners will be insured for a percentage of the list price after allowing for depreciation according to the rule printed in the rate sheet.

No cars are to be insured for a period longer than one year and authorization must be secured before dealers' lines and finance company's business is written. New policies are to be declined on cars more than three years old, except under special authorization, while there is a long list of exceptions of cars manufactured before 1920.

Agents are required to decline insurance on cars unless they are personally acquainted with the applicant and his financial standing, and if there is any question as to his ability to own and maintain a car the company is to be given the benefit of the doubt.

Chevrolet Introduces Organization Journal

DETROIT, Sept. 12—Chevrolet Motor Co. has issued an organization paper, the Chevrolet Sales Speedster, which will be issued twice monthly "in the interests and for the inspiration of all who cooperate in the sale of Chevrolet transportation." The paper is practically dedicated to the proposition that the Chevrolet Model 490, as the second lowest priced car on the market, is entitled to be the second largest owned car on the market.

The paper is directed toward improveing the merchandising efforts of Chevrolet dealers. In the first issue dated Sept. 1 leading articles are headed: "Talk Quality First Then Price," and "A Famous Model Improved."

Manufacturers' Tax Favored by Hanch

Spokesman for N. A. C. C. Testifies in Washington—Wants Repeal of Excise Levies

WASHINGTON, Sept. 14—C. C. Hanch, executive vice-president United States Automotive Corporation and chairman tax committee National Automobile Chamber of Commerce, put the automobile industry on record as in favor of a manufacturers' tax and repeal of all war taxes in testifying before the Senate Finance Committee. It was his contention that the continuation of iniquitous taxes as contemplated in the House bill and proposals of the Treasury Department for internal revenue revision would result in "the perpetuation in this country of a sick prosperity."

As the discussion before the subcommittee of the majority members of the Senate Finance Committee was in behalf of all manufacturing interests, the spokesman for the automotive industry did not deal specifically with so-called "stigma taxes," as the excise taxes on automobiles are known. In substance, the committee representing various groups of manufacturers approved of the revised Smoot taxation plan which will be submitted to the Senate as a separate measure next week. The manufacturers' tax contemplated in the Smoot bill calls for a rate of 3 per cent, though there is a possibility that it may be reduced slightly.

Every speaker insisted that the abolition of war taxes was essential to the economic recovery of the nation. The committee was informed that manufacturers had taken a long step in voluntarily accepting a new burden in the form of a manufacturers' tax. It would mean increased expense in bookkeeping and auditing. It was only fair, they said, that the discriminatory taxes imposed during war conditions should be lifted and production allowed to regain normal status without tax restrictions. This factor is particularly important to the automotive trade at this time, when manufacturers are cutting prices. The war tax item appears as a big item in the final cost of a car.

The manufacturers' tax was defined as an assessment on all finished commodities sold or leased by manufacturers, producers or importers and it would be paid direct by the manufacturer, producer or importer. It was explained that it is not a sales tax as it does not bear on the retailers' sales and would be assessed at point of manufacture only, and consequently prevent pyramiding.

The manufacturers expect general public support for the program on the grounds that it is comparatively simple, bears on all manufacturers uniformly, is not so difficult of collection as many taxes which it would supplant and is a substitute for the existing "nuisance taxes." The program would involve the repeal of all levies not classed as individual or corporation income taxes, inheritance taxes and special taxes on tobacco, narcotics and oleomargarine. Senator Smoot's program provides for revenue from a new customs tariff measure, but this was not mentioned by the manufacturers. Excess profits taxes were discussed in a broad manner and nothing was said of their effect on automotive trade.

Hanch also spoke for the National Automobile Dealers Assn., Motor and Accessory Assn. and Rubber Assn. of America.

HAWAIIAN HORSE AND MULE GIVE WAY TO MOTOR CAR AND TRUCK

SEATTLE, WASH., Sept. 12—The day of the horse has ended in Hawaii, and, as in other parts of the world, his place has been taken by the motor car. Thousands of pleasure cars, trucks and tractors are now in service in the islands and the automobile is in a decidedly flourishing condition.

On the large sugar and pineapple plantations the mule and the horse have about disappeared and this work is now being done almost exclusively by tractors and motor-driven plows.

When the delegates to the press congress of the world come to the territory in October for a two weeks' session they will find that splendid automobile roads lead to every point of interest in the islands, even up to within a few yards of the active volcano of Kilauea on the island of Hawaii. The territory is spending millions yearly on its roads and one of the largest road building programs in its history is being carried out, for which the advent of the automobile is largely responsible.

NEW ROADS IN CAROLINA

RALEIGH, N. C., Sept. 15—The North Carolina State Highway Commission has completed, or has under contract and construction, 1,012.64 miles of road, at a cost of $14,600,753.12, according to recent figures issued by the commission. Three hundred and fifteen miles of this work already has been completed and the remainder will be completed during the next fiscal year of the commission. The cost of the work already completed is $4,040,184.

HUPP MOTORS REPORT

NEW YORK, Sept. 15—The general balance sheet of the Hupp Motors Co. as of June 30, 1921, shows cash on hand of $647,709 as compared with $1,026,048 on the same date last year. Inventories valued at cost were $3,156,141 as against $3,791,368. Accounts payable aggregated $1,828.453 against $1,838,110 last year while the profit and loss surplus was $4,831,768 as compared with $4,002,344 the previous year.

Reductions Bring 50% Ford Increase

First Week Shows Heavy Orders —100,000 Capacity Assured for Fall

DETROIT, Sept. 15—The Ford Motor Co. to-day reports an increase of 50 per cent in orders during the first week following their newest price reductions Sept. 2.

Orders had fallen off in August, due to late summer influences, and some slight stocking has been experienced in the company's 35 branches throughout the country. All of this stock was cleared out in this first week and deliveries are already running behind, especially on enclosed types.

The factory reports orders piling up to an extent that will practically insure capacity production on the present 100,000 monthly basis during September and October.

Texas Service Men Plan Organization

DALLAS, TEX., Sept. 13—For the purpose of a closer co-operation and deriving more benefits and with a view of systematizing the business in Dallas for the purpose of giving the customers the greatest possible benefits for the least money, the automobile service station men of Dallas are forming an organization. The organization will eventually include every service man in the city and when this is completed the automotive business in Dallas will be about the best organized industry in the State. Every line of the business will have organizations of its own and representatives from these organizations will make up the automobile club proper, or rather the automobile dealers association.

Officers of the service men's organization are: N. H. Billing, Overland Co., chairman, and J. R. Stoorza, Franklin Co., secretary.

The service men have already held two meetings and at the next meeting they expect to complete the organization and elect officers for the year. It will then begin holding regular meetings for the purpose of discussing matters of interest to the service men and planning ways to render the customers more efficient service.

SERB TRADE FAIR

LONDON, Aug. 31 (*By Mail*)—A report has just been issued by the British Department of Overseas Trade on the economic resources and industrial conditions of the Serb-Croat-Slovene Kingdom. It drives home the fact that in this as well as in other Balkan countries salvation must come through transport. Considerable improvement has been shown since the war, but much still remains to be done.

METAL MARKETS

DEMAND from the automotive industries, which not so very long ago formed the steel industry's sole sustenance, is coming in temporarily for somewhat less attention because of the more diversiform inquiry. The market is broadening, but not so much in point of the tonnages involved in individual transactions as in the greater variety of the industries showing an interest in offerings. On the basis of the post-armistice experiences of the steel market, economists will some day lay it down as a law that the first phase of a cycle embracing steel market activity consists of buying by the automotive industries and, as the momentum of this buying increases, it tends to bring out till then latent demand from other industries. An unbiased survey of the steel market in the last few months reveals clearly that the automotive industries have once again furnished the tow by which steel producers were enabled to extricate themselves from the rut of utter inertia. Operations have not yet assumed normally large proportions but, in contrast with the depression of a few months ago, they are impressive. Moreover, they are accompanied by a symptom that has been in evidence on previous occasions, when automotive buying had lifted the steel industry out of the mire, a hardening of the market for the kinds of steel products which automotive manufacturers are especially interested in. There have been no advance so far. In fact, none is imminent. The undertone, however, is decidedly steadier, if not stronger. Price increases noted within the last few days on wire and wire products were rather in the nature of corrections than advances. In the general price upheaval several items were cut out of proportion to others and readjustment of these was a foregone conclusion. Lest steel buyers fall into the error, common in Wall Street, of interpreting every diminishment of the Corporation's unfilled tonnage as an indication of untoward conditions in the steel industry, it may be emphasized that the decline in the Corporation's unfilled tonnage on August 31 was chiefly due to heavier shipments in August made possible by improved production conditions and, moreover, resulting in a large measure from eagerness to obtain cash for as much steel in course of production as possible. Production all along the line is slowly but steadily increasing.

Pig Iron.—Bullish gossip continues to be the market's diet, one selling interest outdoing the other in picturing roseate conditions. Further advances have been proclaimed by Middle West producers. Certain it is that all bargains have disappeared from the market and that there is more or less uniformity in the prices quoted by different interests to the few automotive foundries that are just now in the market for pig.

Steel.—Sellers are showing considerably greater reluctance when it comes to accepting bids that entail concessions from current quotations. The sheet market, especially, has gained in firmness and activity. In the Youngstown district independent producers who up to a fortnight ago were supposed to be shading the Corporation's price to the extent of $2 a ton are seemingly striving to obtain the full Corporation price on new business. Cold-rolled strip steel is moving in modest tonnages at around 3.85c., base, Pittsburgh. All in all, automotive demand is of a routine character.

Aluminum.—The feeling persists among importers and resellers that just as there has been a minor movement in copper and lead in the last few weeks, so aluminum will come in for more activity in the near future. Quotations so far, however, remain unaltered.

Copper.—Although there has been no marked increase in domestic or foreign demand and no perceptible diminution of the large accumulations, the copper market has been elevated, ostensibly for the beneficial effect of such an advance on the copper securities situation.

Lead.—Recent price advances by the chief producing interest were ascribed to the large amount of business with which this seller has lately been favored. The "outside" market responded, however, to a certain extent. By way of justification for these advances, it may be said that lead, unlike copper, zinc and aluminum, does not suffer from a large unsold surplus accumulation.

INDUSTRIAL NOTES

United States Motor Truck Co., of Cincinnati, has had made by the Rothacker Film Co. of Chicago, a two reel motion picture of its executives and factory which will be displayed throughout the country in cooperation with agency owners. Zone men will be equipped with a suitcase and projection machine which will permit screening the films in a hotel parlor, hall, salesroom or in an office. If an agency owner has a prospect who cannot be induced to come to a private movie show, he can take the picture to the prospect's office and screen it on the wall. Tracts in foreign languages will be sent abroad.

Coats-Steamer Automobile Co., Indianapolis, incorporated in Delaware for $5,000,000, is seeking a location at Terre Haute, Ind., on which to erect a large manufacturing plant. The company, according to George Rowland, of the Rowland-Power Collieries Co., who made the proposition to the Chamber of Commerce directors, is after a location 600 x 75 feet, with acreage for expansion.

May Body Co., Toledo, O., builders of truck bodies, whose plant here was burned out a few weeks ago, has taken a lease on the plant formerly occupied by the Toledo Bending Co. The company will install new machinery for the manufacture of sail and power boats also.

Coast Tire Co.'s plant is now in operation in Oakland, Cal., turning out 200 tires daily, having been opened with a banquet on September 1. The payroll is now $25,000 a month, is disbursed in the concrete "all-daylight" factory just completed here. Rubber is brought here direct from Java by water, eliminating the shipment of the crude product east and the finished tires back west again.

MOON SALES INCREASE

ST. LOUIS, Sept. 12—The Moon Motor Car Co., which last week made a sharp reduction in prices of its cars, based on 1914 labor, material and production costs, announces that domestic sales for the first six months of this year were 14 per cent larger than for the same period last year. With the lower prices it is expected that the last half of 1921 will equal or exceed the first half.

N.A.C.C. Will Inquire into "Pirate Parts"

Probe to Follow Complaints That Devices Have Hurt Reputation of Cars

NEW YORK, Sept. 12—Directors of the National Automobile Chamber of Commerce have authorized a careful and complete investigation of the question of "pirate parts." It is asserted that an increasingly large number of parts of this character are being placed on the market. Many complaints have been made that when they have been used in the manufacture of motor vehicles they have not given good service and have injured the reputation of the cars in which they were used. Some of the vehicle manufacturers say they have taken up the use of "pirate parts" because they could be purchased for prices considerably lower than those charged for the standard parts which previously have been used.

Believing that a very large number of accidents are caused by over-speeding of motor cars and motor trucks, coupled with the over-loading of the latter, the N. A. C. C. is calling upon police officials of the country for a more strict enforcement of the traffic laws, of which there are a sufficient number on the books, but the provisions of which have been too generally disregarded.

Reports show that over-loading of trucks of all sizes have in some cases harmed the roads and in other cases have overcome even the powerful brake equipment, resulting in accidents that could have been avoided.

The N. A. C. C. believes that a two-ton truck carrying four tons is more dangerous on the highways than a five-ton truck with its normal load of five tons. It indorses the Pennsylvania law which requires each truck to bear a lettering showing its weight, the body weight and the weight of the load which it should carry. The chamber opposes truck bodies of abnormal size and advocates loads which will conform with the recommendations of automobile and highway engineers for one-inch width of tire for each 800 pounds of weight.

Secretary Fenn of the motor truck committee reported to his committee last week that Brigadier General Dawes, Federal Budget Director, had asked for a conference on the best means of liquidating the unserviceable army trucks which are stored at Camp Holabird, Md. Sale of these trucks will interfere very little with the market for new vehicles.

At the quarterly meeting of the truck committee in October, there will be a detailed discussion of truck paper and means of making it more promptly acceptable, either through banks or through truck companies. This question will be discussed by a prominent banker.

The committee also will take up the study of new markets for trucks. Attention will be given first to the street railway industry as a market.

MEN OF THE INDUSTRY

Richard C. Fowler has resigned as assistant sales manager of Delco Light Co. to become vice president of Campbell, Trump & Co., advertising agency of Detroit. Gage C. Tremaine has been named secretary of the company. With the addition of the new officers the agency name has been changed from Campbell, Blood & Trump to Campbell, Trump & Co.

L. L. Murphy has resigned his connection with the Olds sales branch in Detroit to join the Studebaker Detroit branch. Murphy at one time was cashier at the Olds factory.

R. N. Mosher, head of the Michigan Oldsmobile Co. has resigned after 17 years connection with the Olds Motor Works during which time he served as comptroller and later in sales capacities. His plans for the future are not announced.

Olin R. Smith, who for the past three years has been advertising manager of The Moto-Meter Company, Inc., Long Island City, N. Y., has joined the staff of the Palmer Advertising Service, 137 E. 43rd Street, N. Y. C. Smith will specialize on dealer helps such as window and counter displays, direct by mail folders, and dealer material.

Frank G. Eastman has been appointed one of the executives associated with Norval A. Hawkins, director of sales, advertising and service for the General Motors Corp. at Detroit. Eastman was a Detroit newspaper man for several years. He went with the Packard Motor Car Co. in 1911 and soon after was promoted to advertising manager. For the last two years he has been doing special work for the Lincoln Motor Car Co.

C. G. Williams has been appointed manager of the Cleveland branch of the McGraw Tire & Rubber Co. to succeed D. C. Hathaway who has been appointed assistant sales manager of the company. Williams has been assistant branch manager.

William M. Sweet who has been assistant to Alfred P. Sloan, Jr., vice president of the General Motors Corp. in charge of production, will leave the New York headquarters Oct. 1 to take an important executive position with the Klaxon Co. which is a General Motors unit. Sweet formerly was secretary of the Motor and Accessory Mfrs. Ass'n.

C. C. Hanch, vice president of the National Automobile Chamber of Commerce and chairman of its tax committee will soon become executive vice president of the United States Automotive Corp., makers of the Lexington automobile with headquarters in Connersville, Ind. Hanch will have active charge of the operating policies of the corporation, which also includes the Ansted Engineering Co., the Ansted Spring & Axle Co., the Connersville Foundry Corp., The Fayette Painting & Trimming Co. and the Teeton-Hartley Motor Corp.

FINANCIAL NOTES

Jordan Motor Car Co. directors have voted to declare their regular 1¾% quarterly preferred stock dividend payable Sept. 30 to stockholders of record Sept. 20. The company has enjoyed good business for the last quarter showing a good increase in production over the same period 1920.

Columbia Motors Co. of Detroit has filed a balance sheet as of Dec. 31, 1920 which shows cash on hand $118,186, accounts receivable $825,418, stores and material $1,275,933, contracts for parts and materials $3,290,000, accounts payable $26,520, notes payable to banks $575,000, stock outstanding $5,169,440, surplus $42,900 and total assets and liabilities $6,283,816.

The Chandler Motor Car Co. has declared a regular quarterly dividend of $1.15 a share payable Oct. 1 to stockholders of record Sept. 20.

International Harvester Co. of Chicago has declared the regular quarterly common dividend of $1.25 a share payable Oct. 15 to stockholders of record Sept. 24. In June the regular quarterly common dividend of $1.25 and an extra stock dividend of 2% was declared.

Texas Motor Car Assn. has adopted a reorganization plan calling for an assessment of 21 cents per $1 stock.

Kelly Springfield Tire Co. sales are 25% ahead of final figures for August, 1920, despite present lower prices. Final August figures should materially increase this lead. Final July sales were close to $3,000,000. Company has quadrupled its sales without increase in accounts receivable. Existing stocks of tubes held by 126 tire companies placed at three weeks supply and of tires at five weeks supply, based on July sales. This indicates a healthy condition in the industry.

New York Man Appointed Kelly-Springfield Head

SPRINGFIELD, OHIO, Sept. 13—Following the arrival here to-day of Charles Willard Young and Edward O. McDonnell of New York, James L. Geddes, chairman of the board of the Kelly-Springfield Motor Truck Co., announces that Young has been chosen as president of the company. McDonnell was appointed as general manager. Both have been connected with the Emerson-McMillen Co. of New York. Geddes said the company has more orders to-day than any day during the last year and that prospects are extremely bright for the future.

MOTOR TAX TAKEN OUT

WASHINGTON, Sept. 12—New recommendations made to the Senate Finance Committee by Secretary of the Treasury Mellon in reference to taxation do not contain his original proposal for a Federal tax on automobiles. So much opposition to this plan developed that it has been definitely abandoned. He urges repeal of the excess profits tax effective as of January last and of the tax on capital stock for 1922, which was payable July 1 last. Reduction of the high income surtaxes to 25 per cent also is urged. The loss in revenue by repeals and reductions would be partly offset by an increase from 10 to 15 per cent in the tax on the net income of corporations.

S. A. E. AFTER THIEVES

NEW YORK, Sept. 12—The committee of the Society of Automotive Engineers which has been investigating methods of marking both engine blocks and frames in such a manner that they will be difficult of alteration by thieves will meet in Cleveland Sept. 20. The purpose of the committee is to devise some plan which will be practical from an engineering standpoint. The insurance underwriters have offered a discount of 20 per cent for approved markings.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Sept. 15—The Federal Reserve System's statement for Sept. 7 revealed a decline in the reserve ratios as a result of increased note circulation, deposits and total bills on hand—an indication of increased member-bank borrowings. The fall crop moving demands and the need for additional currency over the holiday period were undoubtedly responsible in part for the $36,097,000 increase in Federal Reserve notes in circulation. While gold reserves increased $15,317,000, and cash reserves about the same amount, total bills on hand increased $26,152,000, largely through the increase in the amount of bills purchased in the open market. Total deposits increased $27,314,000. As a result of these changes, the ratio of total reserves to deposit and Federal Reserve note liabilities combined declined from 66.8 per cent to 66.2 per cent. The seasonal effect on the banks was more apparent, however, in the statement of the New York Federal Reserve Bank, where the ratio declined from 75.5 per cent to 72.9 per cent. The flow of funds to the interior was reflected in the decline of $31,188,000 in the New York bank's share of the gold settlement fund. As a consequence the gold reserve of the New York bank declined $18,427,000 in spite of increased holdings of gold and gold certificates, etc.

Call money on the local market last week ranged from 5 to 5½ per cent, as against 4½ per cent to 5½ per cent the week before. The renewal rate was 5½ per cent all week until Friday when there was a decline of ½ per cent. Call money was in rather liberal supply and funds were obtainable on the "outside" market at rates somewhat under the quoted rates. There was an easier tone in the time money market towards the close of the week when 60- and 90-day paper was obtainable at 5½ per cent to 5¾ per cent, while the longer maturities up to 6 months were quoted at 5¾ per cent to 6 per cent. In the previous week all maturities were quoted at the latter figures. There was little activity in the commercial money market, the rates remaining unchanged for 6 months' prime paper. Although there were a number of large-sized bond offerings during the week, they were, in general, well received and had little effect on the money market.

In the past week the striking features of the financial markets were the decline in the German mark and the activity in the cotton market, following the announcement of the short crop. After having declined below 1 cent last week, the mark on Monday of this week reached a new low for all time of $0.0091. Spot cotton reached a high of 20⅛ cents per lb., marking a rise of 9¼ cents from the low point of June.

The foreign trade figures for August showed the largest exports since March, largest imports since May and the largest excess of exports since February.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 9 to 17—Ottawa, Ont., Can.—Ottawa Motor Show.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 14-19—Jersey City, Second Annual Automobile Show of Hudson County Automobile Trade Association. Fourth Regiment Armory.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

Jan. 7-13—New York, National Automobile Show, Madi- Automobile Show, Grand Central Palace. Auspices of N.A.C.C.

Jan. 28-Feb. 2—Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Jan. 30-Feb. 4—Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

Feb. 20 to 25—Louisville, Ky., Louisville Automobile Show, Auspices Louisville Automobile Dealers Association.

FOREIGN SHOWS

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg. Agricultural Sample Exhibition.

Sept. 23-Oct. 2—Berlin, German National Automobile Show, Auspices of German Automobile Mfg. Ass'n and German Automobile Club.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Oct. 10-22—Olympia, England, Truck Show. Nov. 4-12—Car Show. Nov. 28-Dec. 3—Motorcycle Show.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

November 7-14—Paris, Seventh International Exposition of Aerial Locomotion in the Grand Palais of the Champs Elysees, Held by the Chambre Syndicale des Industries Aeronautiques.

March, 1922 — Santiago, Chili, Annual Automobile Show.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

Sept. 14-15-16 — Cleveland, Second International Cost Conference, Auspices National Association of Cost Accountants.

Sept. 14-15-16—Detroit, Credit Convention Motor and Accessory Manufacturers Association.

Oct. 12-14—Chicago, Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

Nov. 15-16—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

Dec. 27-29—Chicago, American Society of Agricultural Engineers, Auditorium Hotel.

S. A. E. MEETINGS

New York, Sept. 15—Fuel Session.

Worcester, Sept. 17—New England Section.

Philadelphia, Sept. 22—Pennsylvania Section.

Detroit, Sept. 23, Oct. 21, Nov. 18, Dec. 23, Feb. 24, March 24, April 28, May 26.

Dayton, Oct. 1—First Fall Meeting.

September Business Improves in Texas

First Ten Days Show Daily Average Record for Entire Year —Trucks Better

DALLAS, TEX., Sept. 12—The automobile business in Texas started off with a rush in September. Reports from dealers and distributers in Dallas for the first ten days of the month showed more cars sold per day than any similar period during the present year. As was the case during August when the retailers of Texas just about established a record business, the majority of the sales were medium priced cars. Retailers attribute the increasing number of sales to continued reduction in prices. The prospective customers appear to think the bottom prices have been reached and they are taking advantage of recent reductions, probably fearing there will be an advance before other reductions come.

Dealers in high priced cars report business stimulated by recent reductions in modern priced automobiles.

What was true with the Dallas retailers was true of the retailers of Fort Worth, Wichita Falls, Waco, Abilene, Amarillo, Sweetwater, San Angelo, Temple, Houston, Galveston, Beaumont, Denison, Sherman, Greenville, Gainsville and a half dozen other Texas cities.

Accessory men said business was better than any ten days for the past twelve months. The garage men said they had all they could do. The tire men were kept busy day and parts of the night.

Truck dealers reported considerable sales with more prospects than they have had for months. They declare the good grain and cotton crops with good prices are stimulating sales.

New Car Developed, To Be Made at Toledo

TOLEDO, O., Sept. 12—A new light car with general dimensions and power plant smaller than those of any car now on the American market has been developed by the Automotive Corp. It is designed as a two-passenger car only and has a wheelbase of 91 in. The engine is a four-cylinder one of 2½ in. bore by 3½ in. stroke; it is air-cooled and is said to develop a maximum of 22 hp. and to turn up to 3500 r.p.m. The valves are located in the cylinder heads and lubrication is by force feed and splash.

The clutch is of the dry disk type and the transmission a three speed and reverse sliding gear type with standard control positions. Transmission to the rear axle is by propeller shaft with a single disk type universal joint at the forward end. Quarter-elliptic cantilever springs are fitted all around. The car is said to weigh 900 lb. and it is to sell at $375, not including top, windshield and spare wheel. The special advantage claimed for the car is high fuel mileage.

FISK-FEDERAL MERGER

NEW YORK, Sept. 12—Consolidation of the Fisk Rubber Co. and the Federal Rubber Co. will have no physical effect but it makes possible refinancing of the two corporations as a single unit and is regarded in financial circles as a constructive measure. Production at the Fisk plant is running about 10,000 per day and at the Federal plant at Cudahy, Wis., at about 2000 per day. Neither company has large stocks of tires on hand and the output is kept close to sales. On the basis of current operations, Fisk soon will be on the market for crude rubber and cotton fabric. It had some high priced materials but they were written down to market levels.

Rumor Durant Will Purchase Peerless

Meeting Expected to Bring Announcement Does Not Materialize—Officers Silent

CLEVELAND, Sept. 14—Reports have been current in Cleveland that an announcement would be forthcoming soon concerning the sale of the Peerless Motor Car Co. to W. C. Durant of Durant Motors, Inc., and it was expected that the announcement might follow a meeting which was to have been held Tuesday. The meeting, however, did not materialize.

B. G. Tremaine, president of the Peerless company, attended a meeting in New York, Tuesday, but other officers of the company have declined to state what subject was taken up.

The report of the sale which has been in circulation is responsible largely for the increase in Peerless stock, which has gone up from $25 a share to $40. The Peerless company is a $10,000,000 corporation, and the Peerless plant in Cleveland covers 20 acres. The company is the only one here which manufactures an eight-cylinder car. It is said that if Durant takes over the company production will be doubled.

TORONTO TRIES BUSES

TORONTO, ONT., Sept. 12—The City Transit Commission, which has recently taken over the trolley lines, has begun experimentation with trackless gasoline propelled motor buses for use in some sections of the city. A bus of the Fifth Avenue type and a Tilling-Stevens vehicle of the type used on London streets have been procured and will be tested out by the Toronto Commission.